

# SEQUENCE LISTING

<110> THE GOVERNMENT OF THE UNITED STATES OF AMERICA AS  
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 HUMAN SERVICES  
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<120> RECOMBINANT HUMAN METAPNEUMOVIRUS AND ITS USE

<130> 4239-67784

<150> US 60/451,119

<151> 2003-02-28

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<160> 36

<170> PatentIn version 3.2

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 aaaattatga cacaagttca aattatgcta aagggaagct aacaagaaat tacatgatac 12840  
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cttaccctaa tatgattaaa ctaatagata acttagggaa tgcagagatt aaaaaactga 13860  
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aaaataagaa attataattg aatgtatacg gtttttttgc cgt 14083

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<213> human metapneumovirus

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Arg Gly Ser Glu Cys Lys Phe Asn His Asn Tyr Trp Ser Trp Pro Asp  
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Arg Tyr Leu Leu Ile Arg Ser Asn Tyr Leu Leu Asn Gln Leu Leu Arg  
35 40 45

Asn Thr Asp Arg Ala Asp Gly Leu Ser Ile Ile Ser Gly Ala Gly Arg  
50 55 60

Glu Asp Arg Thr Gln Asp Phe Val Leu Gly Ser Thr Asn Val Val Gln  
65 70 75 80

Gly Tyr Ile Asp Asp Asn Gln Ser Ile Thr Lys Ala Ala Ala Cys Tyr  
85 90 95



Ser Leu His Asn Ile Ile Lys Gln Leu Gln Glu Val Glu Val Arg Gln  
100 105 110

Ala Arg Asp Ser Lys Leu Ser Asp Ser Lys His Val Ala Leu His Asn  
115 120 125

Leu Ile Leu Ser Tyr Met Glu Met Ser Lys Thr Pro Ala Ser Leu Ile  
130 135 140

Asn Asn Leu Lys Arg Leu Pro Arg Glu Lys Leu Lys Lys Leu Ala Lys  
145 150 155 160

Leu Ile Ile Asp Leu Ser Ala Gly Ala Asp Asn Asp Ser Ser Tyr Ala  
165 170 175

Leu Gln Asp Ser Glu Ser Ile Asn Gln Val Gln  
180 185

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<211> 179  
<212> PRT  
<213> human metapneumovirus

<400> 5

Met Ile Thr Leu Asp Val Ile Lys Ser Asp Gly Ser Ser Lys Thr Cys  
1 5 10 15

Thr His Leu Lys Lys Ile Ile Lys Asp His Ser Gly Lys Val Leu Ile  
20 25 30

Ala Leu Lys Leu Ile Leu Ala Leu Leu Thr Phe Phe Thr Ile Thr Ile  
35 40 45

Thr Ile Asn Tyr Ile Lys Val Glu Asn Asn Leu Gln Ile Cys Gln Ser  
50 55 60

Lys Thr Glu Ser Asp Lys Glu Asp Ser Pro Ser Asn Thr Thr Ser Val  
65 70 75 80

Thr Thr Lys Thr Thr Leu Asp His Asp Ile Thr Gln Tyr Phe Lys Arg  
85 90 95

Leu Ile Gln Arg Tyr Thr Asp Ser Val Ile Asn Lys Asp Thr Cys Trp  
100 105 110

Lys Ile Ser Arg Asn Gln Cys Thr Asn Ile Thr Thr Tyr Lys Phe Leu  
25

115

120

125

Cys Phe Lys Pro Glu Asp Ser Lys Ile Asn Ser Cys Asp Arg Leu Thr  
130 135 140

Asp Leu Cys Arg Asn Lys Ser Lys Ser Ala Ala Glu Ala Tyr His Thr  
145 150 155 160

Val Glu Cys His Cys Ile Tyr Thr Ile Glu Trp Lys Cys Tyr His His  
165 170 175

Ser Ile Asp

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<400> 6

Met Glu Val Lys Val Glu Asn Ile Arg Ala Ile Asp Met Leu Lys Ala  
1 5 10 15

Arg Val Lys Asn Arg Val Ala Arg Ser Lys Cys Phe Lys Asn Ala Ser  
20 25 30

Leu Ile Leu Ile Gly Ile Thr Thr Leu Ser Ile Ala Leu Asn Ile Tyr  
35 40 45

Leu Ile Ile Asn Tyr Thr Ile Gln Lys Thr Ser Ser Glu Ser Glu His  
50 55 60

His Thr Ser Ser Pro Pro Thr Glu Ser Asn Lys Glu Ala Ser Thr Ile  
65 70 75 80

Ser Thr Asp Asn Pro Asp Ile Asn Pro Asn Ser Gln His Pro Thr Gln  
85 90 95

Gln Ser Thr Glu Asn Pro Thr Leu Asn Pro Ala Ala Ser Val Ser Pro  
100 105 110

Ser Glu Thr Glu Pro Ala Ser Thr Pro Asp Thr Thr Asn Arg Leu Ser  
115 120 125

Ser Val Asp Arg Ser Thr Ala Gln Pro Ser Glu Ser Arg Thr Lys Thr  
130 135 140

Lys Pro Thr Val His Thr Arg Asn Asn Pro Ser Thr Ala Ser Ser Thr  
 145 150 155 160

Gln Ser Pro Pro Arg Ala Thr Thr Lys Ala Ile Arg Arg Ala Thr Thr  
 165 170 175

Phe Arg Met Ser Ser Thr Gly Lys Arg Pro Thr Thr Thr Ser Val Gln  
 180 185 190

Ser Asp Ser Ser Thr Thr Thr Gln Asn His Glu Glu Thr Gly Ser Ala  
 195 200 205

Asn Pro Gln Ala Ser Val Ser Thr Met Gln Asn  
 210 215

<210> 7  
 <211> 2005  
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<400> 7

Met Asp Pro Leu Asn Glu Ser Thr Val Asn Val Tyr Leu Pro Asp Ser  
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Tyr Leu Lys Gly Val Ile Ser Phe Ser Glu Thr Asn Ala Ile Gly Ser  
 20 25 30

Cys Leu Leu Lys Arg Pro Tyr Leu Lys Asn Asp Asn Thr Ala Lys Val  
 35 40 45

Ala Ile Glu Asn Pro Val Ile Glu His Val Arg Leu Lys Asn Ala Val  
 50 55 60

Asn Ser Lys Met Lys Ile Ser Asp Tyr Lys Val Val Glu Pro Val Asn  
 65 70 75 80

Met Gln His Glu Ile Met Lys Asn Val His Ser Cys Glu Leu Thr Leu  
 85 90 95

Leu Lys Gln Phe Leu Thr Arg Ser Lys Asn Ile Ser Thr Leu Lys Leu  
 100 105 110

Asn Met Ile Cys Asp Trp Leu Gln Leu Lys Ser Thr Ser Asp Asp Thr  
 115 120 125

Ser Ile Leu Ser Phe Ile Asp Val Glu Phe Ile Pro Ser Trp Val Ser  
 130 135 140

Asn Trp Phe Ser Asn Trp Tyr Asn Leu Asn Lys Leu Ile Leu Glu Phe  
 145 150 155 160

Arg Arg Glu Glu Val Ile Arg Thr Gly Ser Ile Leu Cys Arg Ser Leu  
 165 170 175

Gly Lys Leu Val Phe Ile Val Ser Ser Tyr Gly Cys Ile Val Lys Ser  
 180 185 190

Asn Lys Ser Lys Arg Val Ser Phe Phe Thr Tyr Asn Gln Leu Leu Thr  
 195 200 205

Trp Lys Asp Val Met Leu Ser Arg Phe Asn Ala Asn Phe Cys Ile Trp  
 210 215 220

Val Ser Asn Ser Leu Asn Glu Asn Gln Glu Gly Leu Gly Leu Arg Ser  
 225 230 235 240

Asn Leu Gln Gly Met Leu Thr Asn Lys Leu Tyr Glu Thr Val Asp Tyr  
 245 250 255

Met Leu Ser Leu Cys Cys Asn Glu Gly Phe Ser Leu Val Lys Glu Phe  
 260 265 270

Glu Gly Phe Ile Met Ser Glu Ile Leu Arg Ile Thr Glu His Ala Gln  
 275 280 285

Phe Ser Thr Arg Phe Arg Asn Thr Leu Leu Asn Gly Leu Thr Asp Gln  
 290 295 300

Leu Thr Lys Leu Lys Asn Lys Asn Arg Leu Arg Val His Ser Thr Val  
 305 310 315 320

Leu Glu Asn Asn Asp Tyr Pro Met Tyr Glu Val Val Leu Lys Leu Leu  
 325 330 335

Gly Asp Thr Leu Arg Cys Ile Lys Leu Leu Ile Asn Lys Asn Leu Glu  
 340 345 350

Asn Ala Ala Glu Leu Tyr Tyr Ile Phe Arg Ile Phe Gly His Pro Met  
 355 360 365

Val Asp Glu Arg Asp Ala Met Asp Ala Val Lys Leu Asn Asn Glu Ile  
 370 375 380

Thr Lys Ile Leu Arg Leu Glu Ser Leu Thr Glu Leu Arg Gly Ala Phe  
 385 390 395 400

Ile Leu Arg Ile Ile Lys Gly Phe Val Asp Asn Asn Lys Arg Trp Pro  
 405 410 415

Lys Ile Lys Asn Leu Lys Val Leu Ser Lys Arg Trp Thr Met Tyr Phe  
 420 425 430

Lys Ala Lys Asn Tyr Pro Ser Gln Leu Glu Leu Ser Glu Gln Asp Phe  
 435 440 445

Leu Glu Leu Ala Ala Ile Gln Phe Glu Gln Glu Phe Ser Val Pro Glu  
 450 455 460

Lys Thr Asn Leu Glu Met Val Leu Asn Asp Lys Ala Ile Ser Pro Pro  
 465 470 475 480

Lys Arg Leu Ile Trp Ser Val Tyr Pro Lys Asn Tyr Leu Pro Glu Thr  
 485 490 495

Ile Lys Asn Arg Tyr Leu Glu Glu Thr Phe Asn Ala Ser Asp Ser Leu  
 500 505 510

Lys Thr Arg Arg Val Leu Glu Tyr Tyr Leu Lys Asp Asn Lys Phe Asp  
 515 520 525

Gln Lys Glu Leu Lys Ser Tyr Val Val Arg Gln Glu Tyr Leu Asn Asp  
 530 535 540

Lys Glu His Ile Val Ser Leu Thr Gly Lys Glu Arg Glu Leu Ser Val  
 545 550 555 560

Gly Arg Met Phe Ala Met Gln Pro Gly Lys Gln Arg Gln Ile Gln Ile  
 565 570 575

Leu Ala Glu Lys Leu Leu Ala Asp Asn Ile Val Pro Phe Phe Pro Glu  
 580 585 590

Thr Leu Thr Lys Tyr Gly Asp Leu Asp Leu Gln Arg Ile Met Glu Ile  
 595 600 605

Lys Ser Glu Leu Ser Ser Ile Lys Thr Arg Arg Asn Asp Ser Tyr Asn  
610 615 620

Asn Tyr Ile Ala Arg Ala Ser Ile Val Thr Asp Leu Ser Lys Phe Asn  
625 630 635 640

Gln Ala Phe Arg Tyr Glu Thr Thr Ala Ile Cys Ala Asp Val Ala Asp  
645 650 655

Glu Leu His Gly Thr Gln Ser Leu Phe Cys Trp Leu His Leu Ile Val  
660 665 670

Pro Met Thr Thr Met Ile Cys Ala Tyr Arg His Ala Pro Pro Glu Thr  
675 680 685

Lys Gly Glu Tyr Asp Ile Asp Lys Ile Glu Glu Gln Ser Gly Leu Tyr  
690 695 700

Arg Tyr His Met Gly Gly Ile Glu Gly Trp Cys Gln Lys Leu Trp Thr  
705 710 715 720

Met Glu Ala Ile Ser Leu Leu Asp Val Val Ser Val Lys Thr Arg Cys  
725 730 735

Gln Met Thr Ser Leu Leu Asn Gly Asp Asn Gln Ser Ile Asp Val Ser  
740 745 750

Lys Pro Val Lys Leu Ser Glu Gly Leu Asp Glu Val Lys Ala Asp Tyr  
755 760 765

Arg Leu Ala Val Lys Met Leu Lys Glu Ile Arg Asp Ala Tyr Arg Asn  
770 775 780

Ile Gly His Lys Leu Lys Glu Gly Glu Thr Tyr Ile Ser Arg Asp Leu  
785 790 795 800

Gln Phe Ile Ser Lys Val Ile Gln Ser Glu Gly Val Met His Pro Thr  
805 810 815

Pro Ile Lys Lys Val Leu Arg Val Gly Pro Trp Ile Asn Thr Ile Leu  
820 825 830

Asp Asp Ile Lys Thr Ser Ala Glu Ser Ile Gly Ser Leu Cys Gln Glu  
835 840 845

Leu Glu Phe Arg Gly Glu Ser Ile Ile Val Ser Leu Ile Leu Arg Asn  
850 855 860

Phe Trp Leu Tyr Asn Leu Tyr Met His Glu Ser Lys Gln His Pro Leu  
865 870 875 880

Ala Gly Lys Gln Leu Phe Lys Gln Leu Asn Lys Thr Leu Thr Ser Val  
885 890 895

Gln Arg Phe Phe Glu Ile Lys Arg Glu Asn Glu Val Val Asp Leu Trp  
900 905 910

Met Asn Ile Pro Met Gln Phe Gly Gly Gly Asp Pro Val Val Phe Tyr  
915 920 925

Arg Ser Phe Tyr Arg Arg Thr Pro Asp Phe Leu Thr Glu Ala Ile Ser  
930 935 940

His Val Asp Ile Leu Leu Lys Ile Ser Ala Asn Ile Lys Asn Glu Thr  
945 950 955 960

Lys Val Ser Phe Phe Lys Ala Leu Leu Ser Ile Glu Lys Asn Glu Arg  
965 970 975

Ala Thr Leu Thr Thr Leu Met Arg Asp Pro Gln Ala Val Gly Ser Glu  
980 985 990

Arg Gln Ala Lys Val Thr Ser Asp Ile Asn Arg Thr Ala Val Thr Ser  
995 1000 1005

Ile Leu Ser Leu Ser Pro Asn Gln Leu Phe Ser Asp Ser Ala Ile  
1010 1015 1020

His Tyr Ser Arg Asn Glu Glu Glu Val Gly Ile Ile Ala Glu Asn  
1025 1030 1035

Ile Thr Pro Val Tyr Pro His Gly Leu Arg Val Leu Tyr Glu Ser  
1040 1045 1050

Leu Pro Phe His Lys Ala Glu Lys Val Val Asn Met Ile Ser Gly  
1055 1060 1065

Thr Lys Ser Ile Thr Asn Leu Leu Gln Arg Thr Ser Ala Ile Asn  
1070 1075 1080

Gly	Glu	Asp	Ile	Asp	Arg	Ala	Val	Ser	Met	Met	Leu	Glu	Asn	Leu
1085						1090					1095			
Gly	Leu	Leu	Ser	Arg	Ile	Leu	Ser	Val	Val	Val	Asp	Ser	Ile	Glu
1100						1105					1110			
Ile	Pro	Ile	Lys	Ser	Asn	Gly	Arg	Leu	Ile	Cys	Cys	Gln	Ile	Ser
1115						1120					1125			
Arg	Thr	Leu	Arg	Glu	Thr	Ser	Trp	Asn	Asn	Met	Glu	Ile	Val	Gly
1130						1135					1140			
Val	Thr	Ser	Pro	Ser	Ile	Thr	Thr	Cys	Met	Asp	Val	Ile	Tyr	Ala
1145						1150					1155			
Thr	Ser	Ser	His	Leu	Lys	Gly	Ile	Ile	Ile	Glu	Lys	Phe	Ser	Thr
1160						1165					1170			
Asp	Arg	Thr	Thr	Arg	Gly	Gln	Arg	Gly	Pro	Lys	Ser	Pro	Trp	Val
1175						1180					1185			
Gly	Ser	Ser	Thr	Gln	Glu	Lys	Lys	Leu	Val	Pro	Val	Tyr	Asn	Arg
1190						1195					1200			
Gln	Ile	Leu	Ser	Lys	Gln	Gln	Arg	Glu	Gln	Leu	Glu	Ala	Ile	Gly
1205						1210					1215			
Lys	Met	Arg	Trp	Val	Tyr	Lys	Gly	Thr	Pro	Gly	Leu	Arg	Arg	Leu
1220						1225					1230			
Leu	Asn	Lys	Ile	Cys	Leu	Gly	Ser	Leu	Gly	Ile	Ser	Tyr	Lys	Cys
1235						1240					1245			
Val	Lys	Pro	Leu	Leu	Pro	Arg	Phe	Met	Ser	Val	Asn	Phe	Leu	His
1250						1255					1260			
Arg	Leu	Ser	Val	Ser	Ser	Arg	Pro	Met	Glu	Phe	Pro	Ala	Ser	Val
1265						1270					1275			
Pro	Ala	Tyr	Arg	Thr	Thr	Asn	Tyr	His	Phe	Asp	Thr	Ser	Pro	Ile
1280						1285					1290			
Asn	Gln	Ala	Leu	Ser	Glu	Arg	Phe	Gly	Asn	Glu	Asp	Ile	Asn	Leu
1295						1300					1305			



Val	Phe	Gln	Asn	Ala	Ile	Ser	Cys	Gly	Ile	Ser	Ile	Met	Ser	Val
1310						1315					1320			
Val	Glu	Gln	Leu	Thr	Gly	Arg	Ser	Pro	Lys	Gln	Leu	Val	Leu	Ile
1325						1330					1335			
Pro	Gln	Leu	Glu	Glu	Ile	Asp	Ile	Met	Pro	Pro	Pro	Val	Phe	Gln
1340						1345					1350			
Gly	Lys	Phe	Asn	Tyr	Lys	Leu	Val	Asp	Lys	Ile	Thr	Ser	Asp	Gln
1355						1360					1365			
His	Ile	Phe	Ser	Pro	Asp	Lys	Ile	Asp	Met	Leu	Thr	Leu	Gly	Lys
1370						1375					1380			
Met	Leu	Met	Pro	Thr	Ile	Lys	Gly	Gln	Lys	Thr	Asp	Gln	Phe	Leu
1385						1390					1395			
Asn	Lys	Arg	Glu	Asn	Tyr	Phe	His	Gly	Asn	Asn	Leu	Ile	Glu	Ser
1400						1405					1410			
Leu	Ser	Ala	Ala	Leu	Ala	Cys	His	Trp	Cys	Gly	Ile	Leu	Thr	Glu
1415						1420					1425			
Gln	Cys	Ile	Glu	Asn	Asn	Ile	Phe	Lys	Lys	Asp	Trp	Gly	Asp	Gly
1430						1435					1440			
Phe	Ile	Ser	Asp	His	Ala	Phe	Met	Asp	Phe	Lys	Ile	Phe	Leu	Cys
1445						1450					1455			
Val	Phe	Lys	Thr	Lys	Leu	Leu	Cys	Ser	Trp	Gly	Ser	Gln	Gly	Lys
1460						1465					1470			
Asn	Ile	Lys	Asp	Glu	Asp	Ile	Val	Asp	Glu	Ser	Ile	Asp	Lys	Leu
1475						1480					1485			
Leu	Arg	Ile	Asp	Asn	Thr	Phe	Trp	Arg	Met	Phe	Ser	Lys	Val	Met
1490						1495					1500			
Phe	Glu	Pro	Lys	Val	Lys	Lys	Arg	Ile	Met	Leu	Tyr	Asp	Val	Lys
1505						1510					1515			
Phe	Leu	Ser	Leu	Val	Gly	Tyr	Ile	Gly	Phe	Lys	Asn	Trp	Phe	Ile
1520						1525					1530			

Glu Gln	Leu Arg Ser Ala	Glu	Leu His Glu Ile	Pro	Trp Ile Val
1535		1540		1545	
Asn Ala	Glu Gly Asp Leu	Val	Glu Ile Lys Ser	Ile	Lys Ile Tyr
1550		1555		1560	
Leu Gln	Leu Ile Glu Gln	Ser	Leu Phe Leu Arg	Ile	Thr Val Leu
1565		1570		1575	
Asn Tyr	Thr Asp Met Ala	His	Ala Leu Thr Arg	Leu	Ile Arg Lys
1580		1585		1590	
Lys Leu	Met Cys Asp Asn	Ala	Leu Leu Thr Pro	Ile	Ser Ser Pro
1595		1600		1605	
Met Val	Asn Leu Thr Gln	Val	Ile Asp Pro Thr	Thr	Gln Leu Asp
1610		1615		1620	
Tyr Phe	Pro Lys Ile Thr	Phe	Glu Arg Leu Lys	Asn	Tyr Asp Thr
1625		1630		1635	
Ser Ser	Asn Tyr Ala Lys	Gly	Lys Leu Thr Arg	Asn	Tyr Met Ile
1640		1645		1650	
Leu Leu	Pro Trp Gln His	Val	Asn Arg Tyr Asn	Phe	Val Phe Ser
1655		1660		1665	
Ser Thr	Gly Cys Lys Val	Ser	Leu Lys Thr Cys	Ile	Gly Lys Leu
1670		1675		1680	
Met Lys	Asp Leu Asn Pro	Lys	Val Leu Tyr Phe	Ile	Gly Glu Gly
1685		1690		1695	
Ala Gly	Asn Trp Met Ala	Arg	Thr Ala Cys Glu	Tyr	Pro Asp Ile
1700		1705		1710	
Lys Phe	Val Tyr Arg Ser	Leu	Lys Asp Asp Leu	Asp	His His Tyr
1715		1720		1725	
Pro Leu	Glu Tyr Gln Arg	Val	Ile Gly Glu Leu	Ser	Arg Ile Ile
1730		1735		1740	
Asp Ser	Gly Glu Gly Leu	Ser	Met Glu Thr Thr	Asp	Ala Thr Gln
1745		1750		1755	

Lys	Thr	His	Trp	Asp	Leu	Ile	His	Arg	Val	Ser	Lys	Asp	Ala	Leu
1760						1765					1770			
Leu	Ile	Thr	Leu	Cys	Asp	Ala	Glu	Phe	Lys	Asp	Arg	Asp	Asp	Phe
1775						1780					1785			
Phe	Lys	Met	Val	Ile	Leu	Trp	Arg	Lys	His	Val	Leu	Ser	Cys	Arg
1790						1795					1800			
Ile	Cys	Thr	Thr	Tyr	Gly	Thr	Asp	Leu	Tyr	Leu	Phe	Ala	Lys	Tyr
1805						1810					1815			
His	Ala	Lys	Asp	Cys	Asn	Val	Lys	Leu	Pro	Phe	Phe	Val	Arg	Ser
1820						1825					1830			
Val	Ala	Thr	Phe	Ile	Met	Gln	Gly	Ser	Lys	Leu	Ser	Gly	Ser	Glu
1835						1840					1845			
Cys	Tyr	Ile	Leu	Leu	Thr	Leu	Gly	His	His	Asn	Ser	Leu	Pro	Cys
1850						1855					1860			
His	Gly	Glu	Ile	Gln	Asn	Ser	Lys	Met	Lys	Ile	Ala	Val	Cys	Asn
1865						1870					1875			
Asp	Phe	Tyr	Ala	Ala	Lys	Lys	Leu	Asp	Asn	Lys	Ser	Ile	Glu	Ala
1880						1885					1890			
Asn	Cys	Lys	Ser	Leu	Leu	Ser	Gly	Leu	Arg	Ile	Pro	Ile	Asn	Lys
1895						1900					1905			
Lys	Glu	Leu	Asp	Arg	Gln	Arg	Arg	Leu	Leu	Thr	Leu	Gln	Ser	Asn
1910						1915					1920			
His	Ser	Ser	Val	Ala	Thr	Val	Gly	Gly	Ser	Lys	Ile	Ile	Glu	Ser
1925						1930					1935			
Lys	Trp	Leu	Thr	Asn	Lys	Ala	Ser	Thr	Ile	Ile	Asp	Trp	Leu	Glu
1940						1945					1950			
His	Ile	Leu	Asn	Ser	Pro	Lys	Gly	Glu	Leu	Asn	Tyr	Asp	Phe	Phe
1955						1960					1965			
Glu	Ala	Leu	Glu	Asn	Thr	Tyr	Pro	Asn	Met	Ile	Lys	Leu	Ile	Asp
1970						1975					1980			

Asn Leu Gly Asn Ala Glu Ile Lys Lys Leu Ile Lys Val Thr Gly  
 1985 1990 1995

Tyr Met Leu Val Ser Lys Lys  
 2000 2005

<210> 8  
 <211> 177  
 <212> PRT  
 <213> human metapneumovirus

<400> 8

Met Lys Thr Leu Asp Val Ile Lys Ser Asp Gly Ser Ser Glu Thr Cys  
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Asn Gln Leu Lys Lys Ile Ile Lys Lys His Ser Gly Lys Leu Leu Ile  
 20 25 30

Ala Ser Lys Pro Thr Leu Ala Leu Leu Thr Ser Phe Thr Val Thr Ile  
 35 40 45

Thr Val Asn Tyr Thr Lys Val Glu Asn Asn Leu Gln Ala Cys Gln Leu  
 50 55 60

Lys Asn Glu Ser Asp Lys Lys Asp Thr Lys Leu Asn Thr Thr Ser Thr  
 65 70 75 80

Thr Ile Arg Pro Ile Pro Asp Leu Asn Ala Val Gln Tyr Leu Lys Arg  
 85 90 95

Leu Ile Gln Lys His Thr Asn Ser Val Thr Lys Asp Arg Asp Thr Cys  
 100 105 110

Trp Arg Ile His Thr Asn Gln Cys Thr Asn Ile Lys Ile Tyr Lys Phe  
 115 120 125

Leu Cys Phe Gly Ser Met Asn Ser Thr Asn Thr Asp Cys Glu Glu Pro  
 130 135 140

Thr Val Leu Cys Asp Lys Lys Ser Lys Thr Met Thr Glu Lys His Arg  
 145 150 155 160

Lys Ala Glu Cys His Arg Pro His Thr Thr Glu Trp Trp Cys His Tyr  
 165 170 175

Leu

<210> 9  
<211> 236  
<212> PRT  
<213> human metapneumovirus

<400> 9

Met Glu Ala Arg Val Glu Asn Ile Arg Ala Ile Asp Met Phe Lys Ala  
1 5 10 15

Lys Met Lys Asn Arg Ile Arg Ser Ser Lys Cys His Arg Asn Ala Thr  
20 25 30

Leu Ile Leu Ile Gly Ser Thr Ala Pro Ser Met Ala Leu Asn Thr Leu  
35 40 45

Leu Ile Ile Asp His Ala Thr Ser Lys Asn Met Thr Lys Val Glu His  
50 55 60

Cys Val Asn Met Pro Pro Val Glu Pro Ser Lys Lys Thr Pro Met Thr  
65 70 75 80

Ser Ala Ala Asp Pro Asn Thr Lys Pro Asn Pro Gln Gln Ala Thr Gln  
85 90 95

Leu Thr Thr Glu Asp Ser Thr Ser Leu Ala Ala Thr Leu Glu Asp His  
100 105 110

Leu His Thr Gly Thr Thr Pro Thr Pro Asp Ala Thr Val Ser Gln Gln  
115 120 125

Thr Thr Asp Glu His Thr Thr Leu Leu Arg Ser Thr Asn Arg Gln Thr  
130 135 140

Thr Gln Thr Thr Ala Glu Lys Lys Pro Thr Arg Ala Thr Thr Lys Lys  
145 150 155 160

Glu Thr Thr Thr Arg Thr Thr Ser Thr Ala Ala Thr Gln Thr Leu Asn  
165 170 175

Thr Thr Asn Gln Thr Ser Asn Gly Arg Glu Ala Thr Thr Thr Ser Ala  
180 185 190

Arg Ser Arg Asn Asn Ala Thr Thr Gln Ser Ser Asp Gln Thr Thr Gln

Ala Ala Asp Pro Ser Ser Gln Ser Gln His Thr Gln Lys Ser Thr Thr  
 210 215 220

Thr Thr His Asn Thr Asp Thr Ser Ser Pro Ser Ser  
 225 230 235

<210> 10  
 <211> 183  
 <212> PRT  
 <213> human metapneumovirus

<400> 10

Met Ile Thr Leu Asp Val Ile Lys Ser Asp Gly Ser Ser Lys Thr Cys  
 1 5 10 15

Thr His Leu Lys Lys Ile Ile Lys Asp His Ser Gly Lys Val Leu Ile  
 20 25 30

Val Leu Lys Leu Ile Leu Ala Leu Leu Thr Phe Leu Thr Val Thr Ile  
 35 40 45

Thr Ile Asn Tyr Ile Lys Val Glu Asn Asn Leu Gln Ile Cys Gln Ser  
 50 55 60

Lys Thr Glu Ser Asp Lys Lys Asp Ser Ser Ser Asn Thr Thr Ser Val  
 65 70 75 80

Thr Thr Lys Thr Thr Leu Asn His Asp Ile Thr Gln Tyr Phe Lys Ser  
 85 90 95

Leu Ile Gln Arg Tyr Thr Asn Ser Ala Ile Asn Ser Asp Thr Cys Trp  
 100 105 110

Lys Ile Asn Arg Asn Gln Cys Thr Asn Ile Thr Thr Tyr Lys Phe Leu  
 115 120 125

Cys Phe Lys Ser Glu Asp Thr Lys Thr Asn Asn Cys Asp Lys Leu Thr  
 130 135 140

Asp Leu Cys Arg Asn Lys Pro Lys Pro Ala Val Gly Val Tyr His Ile  
 145 150 155 160

Val Glu Cys His Cys Ile Tyr Thr Val Lys Trp Lys Cys Tyr His Tyr  
 165 170 175

Pro Thr Asp Glu Thr Gln Ser  
180

<210> 11  
<211> 236  
<212> PRT  
<213> human metapneumovirus

<400> 11

Met Glu Val Lys Val Glu Asn Ile Arg Thr Ile Asp Met Leu Lys Ala  
1 5 10 15

Arg Val Lys Asn Arg Val Ala Arg Ser Lys Cys Phe Lys Asn Ala Ser  
20 25 30

Leu Val Leu Ile Gly Ile Thr Thr Leu Ser Ile Ala Leu Asn Ile Tyr  
35 40 45

Leu Ile Ile Asn Tyr Lys Met Gln Lys Asn Thr Ser Glu Ser Glu His  
50 55 60

His Thr Ser Ser Ser Pro Met Glu Ser Ser Arg Glu Thr Pro Thr Val  
65 70 75 80

Pro Thr Asp Asn Ser Asp Thr Asn Ser Ser Pro Gln His Pro Thr Gln  
85 90 95

Gln Ser Thr Glu Gly Ser Thr Leu Tyr Phe Ala Ala Ser Ala Ser Ser  
100 105 110

Pro Glu Thr Glu Pro Thr Ser Thr Pro Asp Thr Thr Asn Arg Pro Pro  
115 120 125

Phe Val Asp Thr His Thr Thr Pro Pro Ser Ala Ser Arg Thr Lys Thr  
130 135 140

Ser Pro Ala Val His Thr Lys Asn Asn Pro Arg Thr Ser Ser Arg Thr  
145 150 155 160

His Ser Pro Pro Arg Ala Thr Thr Arg Thr Ala Arg Arg Thr Thr Thr  
165 170 175

Leu Arg Thr Ser Ser Thr Arg Lys Arg Pro Ser Thr Ala Ser Val Gln  
180 185 190

Pro Asp Ile Ser Ala Thr Thr His Lys Asn Glu Glu Ala Ser Pro Ala  
 195 200 205

Ser Pro Gln Thr Ser Ala Ser Thr Thr Arg Ile Gln Arg Lys Ser Val  
 210 215 220

Glu Ala Asn Thr Ser Thr Thr Tyr Asn Gln Thr Ser  
 225 230 235

<210> 12  
 <211> 2005  
 <212> PRT  
 <213> human metapneumovirus

<400> 12

Met Asp Pro Leu Asn Glu Ser Thr Val Asn Val Tyr Leu Pro Asp Ser  
 1 5 10 15

Tyr Leu Lys Gly Val Ile Ser Phe Ser Glu Thr Asn Ala Ile Gly Ser  
 20 25 30

Cys Leu Leu Lys Arg Pro Tyr Leu Lys Asn Asp Asn Thr Ala Lys Val  
 35 40 45

Ala Ile Glu Asn Pro Val Ile Glu His Val Arg Leu Lys Asn Ala Val  
 50 55 60

Asn Ser Lys Met Lys Ile Ser Asp Tyr Lys Ile Val Glu Pro Val Asn  
 65 70 75 80

Met Gln His Glu Ile Met Lys Asn Val His Ser Cys Glu Leu Thr Leu  
 85 90 95

Leu Lys Gln Phe Leu Thr Arg Ser Lys Asn Ile Ser Thr Leu Lys Leu  
 100 105 110

Asn Met Ile Cys Asp Trp Leu Gln Leu Lys Ser Thr Ser Asp Asp Thr  
 115 120 125

Ser Ile Leu Ser Phe Ile Asp Val Glu Phe Ile Pro Ser Trp Val Ser  
 130 135 140

Asn Trp Phe Ser Asn Trp Tyr Asn Leu Asn Lys Leu Ile Leu Glu Phe  
 145 150 155 160



Arg Lys Glu Glu Val Ile Arg Thr Gly Ser Ile Leu Cys Arg Ser Leu  
165 170 175

Gly Lys Leu Val Phe Val Val Ser Ser Tyr Gly Cys Ile Val Lys Ser  
180 185 190

Asn Lys Ser Lys Arg Val Ser Phe Phe Thr Tyr Asn Gln Leu Leu Thr  
195 200 205

Trp Lys Asp Val Met Leu Ser Arg Phe Asn Ala Asn Phe Cys Ile Trp  
210 215 220

Val Ser Asn Ser Leu Asn Glu Asn Gln Glu Gly Leu Gly Leu Arg Ser  
225 230 235 240

Asn Leu Gln Gly Ile Leu Thr Asn Lys Leu Tyr Glu Thr Val Asp Tyr  
245 250 255

Met Leu Ser Leu Cys Cys Asn Glu Gly Phe Ser Leu Val Lys Glu Phe  
260 265 270

Glu Gly Phe Ile Met Ser Glu Ile Leu Arg Ile Thr Glu His Ala Gln  
275 280 285

Phe Ser Thr Arg Phe Arg Asn Thr Leu Leu Asn Gly Leu Thr Asp Gln  
290 295 300

Leu Thr Lys Leu Lys Asn Lys Asn Arg Leu Arg Val His Gly Thr Val  
305 310 315 320

Leu Glu Asn Asn Asp Tyr Pro Met Tyr Glu Val Val Leu Lys Leu Leu  
325 330 335

Gly Asp Thr Leu Arg Cys Ile Lys Leu Leu Ile Asn Lys Asn Leu Glu  
340 345 350

Asn Ala Ala Glu Leu Tyr Tyr Ile Phe Arg Ile Phe Gly His Pro Met  
355 360 365

Val Asp Glu Arg Asp Ala Met Asp Ala Val Lys Leu Asn Asn Glu Ile  
370 375 380

Thr Lys Ile Leu Arg Trp Glu Ser Leu Thr Glu Leu Arg Gly Ala Phe  
385 390 395 400

Ile Leu Arg Ile Ile Lys Gly Phe Val Asp Asn Asn Lys Arg Trp Pro  
 405 410 415

Lys Ile Lys Asn Leu Lys Val Leu Ser Lys Arg Trp Thr Met Tyr Phe  
 420 425 430

Lys Ala Lys Ser Tyr Pro Ser Gln Leu Glu Leu Ser Glu Gln Asp Phe  
 435 440 445

Leu Glu Leu Ala Ala Ile Gln Phe Glu Gln Glu Phe Ser Val Pro Glu  
 450 455 460

Lys Thr Asn Leu Glu Met Val Leu Asn Asp Lys Ala Ile Ser Pro Pro  
 465 470 475 480

Lys Arg Leu Ile Trp Ser Val Tyr Pro Lys Asn Tyr Leu Pro Glu Lys  
 485 490 495

Ile Lys Asn Arg Tyr Leu Glu Glu Thr Phe Asn Ala Ser Asp Ser Leu  
 500 505 510

Lys Thr Arg Arg Val Leu Glu Tyr Tyr Leu Lys Asp Asn Lys Phe Asp  
 515 520 525

Gln Lys Glu Leu Lys Ser Tyr Val Val Lys Gln Glu Tyr Leu Asn Asp  
 530 535 540

Lys Asp His Ile Val Ser Leu Thr Gly Lys Glu Arg Glu Leu Ser Val  
 545 550 555 560

Gly Arg Met Phe Ala Met Gln Pro Gly Lys Gln Arg Gln Ile Gln Ile  
 565 570 575

Leu Ala Glu Lys Leu Leu Ala Asp Asn Ile Val Pro Phe Phe Pro Glu  
 580 585 590

Thr Leu Thr Lys Tyr Gly Asp Leu Asp Leu Gln Arg Ile Met Glu Ile  
 595 600 605

Lys Ser Glu Leu Ser Ser Ile Lys Thr Arg Arg Asn Asp Ser Tyr Asn  
 610 615 620

Asn Tyr Ile Ala Arg Ala Ser Ile Val Thr Asp Leu Ser Lys Phe Asn  
 625 630 635 640

Gln Ala Phe Arg Tyr Glu Thr Thr Ala Ile Cys Ala Asp Val Ala Asp  
645 650 655

Glu Leu His Gly Thr Gln Ser Leu Phe Cys Trp Leu His Leu Ile Val  
660 665 670

Pro Met Thr Thr Met Ile Cys Ala Tyr Arg His Ala Pro Pro Glu Thr  
675 680 685

Lys Gly Glu Tyr Asp Ile Asp Lys Ile Glu Glu Gln Ser Gly Leu Tyr  
690 695 700

Arg Tyr His Met Gly Gly Ile Glu Gly Trp Cys Gln Lys Leu Trp Thr  
705 710 715 720

Met Glu Ala Ile Ser Leu Leu Asp Val Val Ser Val Lys Thr Arg Cys  
725 730 735

Gln Met Thr Ser Leu Leu Asn Gly Asp Asn Gln Ser Ile Asp Val Ser  
740 745 750

Lys Pro Val Lys Leu Ser Glu Gly Leu Asp Glu Val Lys Ala Asp Tyr  
755 760 765

Ser Leu Ala Val Lys Met Leu Lys Glu Ile Arg Asp Ala Tyr Arg Asn  
770 775 780

Ile Gly His Lys Leu Lys Glu Gly Glu Thr Tyr Ile Ser Arg Asp Leu  
785 790 795 800

Gln Phe Ile Ser Lys Val Ile Gln Ser Glu Gly Val Met His Pro Thr  
805 810 815

Pro Ile Lys Lys Ile Leu Arg Val Gly Pro Trp Ile Asn Thr Ile Leu  
820 825 830

Asp Asp Ile Lys Thr Ser Ala Glu Ser Ile Gly Ser Leu Cys Gln Glu  
835 840 845

Leu Glu Phe Arg Gly Glu Ser Ile Ile Val Ser Leu Ile Leu Arg Asn  
850 855 860

Phe Trp Leu Tyr Asn Leu Tyr Met His Glu Ser Lys Gln His Pro Leu  
865 870 875 880

Ala Gly Lys Gln Leu Phe Lys Gln Leu Asn Lys Thr Leu Thr Ser Val  
885 890 895

Gln Arg Phe Phe Glu Ile Lys Lys Glu Asn Glu Val Val Asp Leu Trp  
900 905 910

Met Asn Ile Pro Met Gln Phe Gly Gly Gly Asp Pro Val Val Phe Tyr  
915 920 925

Arg Ser Phe Tyr Arg Arg Thr Pro Asp Phe Leu Thr Glu Ala Ile Ser  
930 935 940

His Val Asp Ile Leu Leu Arg Ile Ser Ala Asn Ile Arg Asn Glu Ala  
945 950 955 960

Lys Ile Ser Phe Phe Lys Ala Leu Leu Ser Ile Glu Lys Asn Glu Arg  
965 970 975

Ala Thr Leu Thr Thr Leu Met Arg Asp Pro Gln Ala Val Gly Ser Glu  
980 985 990

Arg Gln Ala Lys Val Thr Ser Asp Ile Asn Arg Thr Ala Val Thr Ser  
995 1000 1005

Ile Leu Ser Leu Ser Pro Asn Gln Leu Phe Ser Asp Ser Ala Ile  
1010 1015 1020

His Tyr Ser Arg Asn Glu Glu Glu Val Gly Ile Ile Ala Asp Asn  
1025 1030 1035

Ile Thr Pro Val Tyr Pro His Gly Leu Arg Val Leu Tyr Glu Ser  
1040 1045 1050

Leu Pro Phe His Lys Ala Glu Lys Val Val Asn Met Ile Ser Gly  
1055 1060 1065

Thr Lys Ser Ile Thr Asn Leu Leu Gln Arg Thr Ser Ala Ile Asn  
1070 1075 1080

Gly Glu Asp Ile Asp Arg Ala Val Ser Met Met Leu Glu Asn Leu  
1085 1090 1095

Gly Leu Leu Ser Arg Ile Leu Ser Val Val Val Asp Ser Ile Glu  
1100 1105 1110

Ile	Pro	Thr	Lys	Ser	Asn	Gly	Arg	Leu	Ile	Cys	Cys	Gln	Ile	Ser
1115						1120						1125		
Arg	Thr	Leu	Arg	Glu	Thr	Ser	Trp	Asn	Asn	Met	Glu	Ile	Val	Gly
1130						1135					1140			
Val	Thr	Ser	Pro	Ser	Ile	Thr	Thr	Cys	Met	Asp	Val	Ile	Tyr	Ala
1145						1150					1155			
Thr	Ser	Ser	His	Leu	Lys	Gly	Ile	Ile	Ile	Glu	Lys	Phe	Ser	Thr
1160						1165					1170			
Asp	Arg	Thr	Thr	Arg	Gly	Gln	Arg	Gly	Pro	Lys	Ser	Pro	Trp	Val
1175						1180					1185			
Gly	Ser	Ser	Thr	Gln	Glu	Lys	Lys	Leu	Val	Pro	Val	Tyr	Asn	Arg
1190						1195					1200			
Gln	Ile	Leu	Ser	Lys	Gln	Gln	Arg	Glu	Gln	Leu	Glu	Ala	Ile	Gly
1205						1210					1215			
Lys	Met	Arg	Trp	Val	Tyr	Lys	Gly	Thr	Pro	Gly	Leu	Arg	Arg	Leu
1220						1225					1230			
Leu	Asn	Lys	Ile	Cys	Leu	Gly	Ser	Leu	Gly	Ile	Ser	Tyr	Lys	Cys
1235						1240					1245			
Val	Lys	Pro	Leu	Leu	Pro	Arg	Phe	Met	Ser	Val	Asn	Phe	Leu	His
1250						1255					1260			
Arg	Leu	Ser	Val	Ser	Ser	Arg	Pro	Met	Glu	Phe	Pro	Ala	Ser	Val
1265						1270					1275			
Pro	Ala	Tyr	Arg	Thr	Thr	Asn	Tyr	His	Phe	Asp	Thr	Ser	Pro	Ile
1280						1285					1290			
Asn	Gln	Ala	Leu	Ser	Glu	Arg	Phe	Gly	Asn	Glu	Asp	Ile	Asn	Leu
1295						1300					1305			
Val	Phe	Gln	Asn	Ala	Ile	Ser	Cys	Gly	Ile	Ser	Ile	Met	Ser	Val
1310						1315					1320			
Val	Glu	Gln	Leu	Thr	Gly	Arg	Ser	Pro	Lys	Gln	Leu	Val	Leu	Ile
1325						1330					1335			

Pro	Gln	Leu	Glu	Glu	Ile	Asp	Ile	Met	Pro	Pro	Pro	Val	Phe	Gln
1340						1345						1350		
Gly	Lys	Phe	Asn	Tyr	Lys	Leu	Val	Asp	Lys	Ile	Thr	Ser	Asp	Gln
1355						1360						1365		
His	Ile	Phe	Ser	Pro	Asp	Lys	Ile	Asp	Met	Leu	Thr	Leu	Gly	Lys
1370						1375						1380		
Met	Leu	Met	Pro	Thr	Ile	Lys	Gly	Gln	Lys	Thr	Asp	Gln	Phe	Leu
1385						1390						1395		
Asn	Lys	Arg	Glu	Asn	Tyr	Phe	His	Gly	Asn	Asn	Leu	Ile	Glu	Ser
1400						1405						1410		
Leu	Ser	Ala	Ala	Leu	Ala	Cys	His	Trp	Cys	Gly	Ile	Leu	Thr	Glu
1415						1420						1425		
Gln	Cys	Ile	Glu	Asn	Asn	Ile	Phe	Lys	Lys	Asp	Trp	Gly	Asp	Gly
1430						1435						1440		
Phe	Ile	Ser	Asp	His	Ala	Phe	Met	Asp	Phe	Lys	Ile	Phe	Leu	Cys
1445						1450						1455		
Val	Phe	Lys	Thr	Lys	Leu	Leu	Cys	Ser	Trp	Gly	Ser	Gln	Gly	Lys
1460						1465						1470		
Asn	Ile	Lys	Asp	Glu	Asp	Ile	Val	Asp	Glu	Ser	Ile	Asp	Lys	Leu
1475						1480						1485		
Leu	Arg	Ile	Asp	Asn	Thr	Phe	Trp	Arg	Met	Phe	Ser	Lys	Val	Met
1490						1495						1500		
Phe	Glu	Ser	Lys	Val	Lys	Lys	Arg	Ile	Met	Leu	Tyr	Asp	Val	Lys
1505						1510						1515		
Phe	Leu	Ser	Leu	Val	Gly	Tyr	Ile	Gly	Phe	Lys	Asn	Trp	Phe	Ile
1520						1525						1530		
Glu	Gln	Leu	Arg	Ser	Ala	Glu	Leu	His	Glu	Val	Pro	Trp	Ile	Val
1535						1540						1545		
Asn	Ala	Glu	Gly	Asp	Leu	Val	Glu	Ile	Lys	Ser	Ile	Lys	Ile	Tyr
1550						1555						1560		

Leu	Gln	Leu	Ile	Glu	Gln	Ser	Leu	Phe	Leu	Arg	Ile	Thr	Val	Leu
1565						1570					1575			
Asn	Tyr	Thr	Asp	Met	Ala	His	Ala	Leu	Thr	Arg	Leu	Ile	Arg	Lys
1580						1585					1590			
Lys	Leu	Met	Cys	Asp	Asn	Ala	Leu	Leu	Thr	Pro	Ile	Pro	Ser	Pro
1595						1600					1605			
Met	Val	Asn	Leu	Thr	Gln	Val	Ile	Asp	Pro	Thr	Glu	Gln	Leu	Ala
1610						1615					1620			
Tyr	Phe	Pro	Lys	Ile	Thr	Phe	Glu	Arg	Leu	Lys	Asn	Tyr	Asp	Thr
1625						1630					1635			
Ser	Ser	Asn	Tyr	Ala	Lys	Gly	Lys	Leu	Thr	Arg	Asn	Tyr	Met	Ile
1640						1645					1650			
Leu	Leu	Pro	Trp	Gln	His	Val	Asn	Arg	Tyr	Asn	Phe	Val	Phe	Ser
1655						1660					1665			
Ser	Thr	Gly	Cys	Lys	Val	Ser	Leu	Lys	Thr	Cys	Ile	Gly	Lys	Leu
1670						1675					1680			
Met	Lys	Asp	Leu	Asn	Pro	Lys	Val	Leu	Tyr	Phe	Ile	Gly	Glu	Gly
1685						1690					1695			
Ala	Gly	Asn	Trp	Met	Ala	Arg	Thr	Ala	Cys	Glu	Tyr	Pro	Asp	Ile
1700						1705					1710			
Lys	Phe	Val	Tyr	Arg	Ser	Leu	Lys	Asp	Asp	Leu	Asp	His	His	Tyr
1715						1720					1725			
Pro	Leu	Glu	Tyr	Gln	Arg	Val	Ile	Gly	Glu	Leu	Ser	Arg	Ile	Ile
1730						1735					1740			
Asp	Ser	Gly	Glu	Gly	Leu	Ser	Met	Glu	Thr	Thr	Asp	Ala	Thr	Gln
1745						1750					1755			
Lys	Thr	His	Trp	Asp	Leu	Ile	His	Arg	Val	Ser	Lys	Asp	Ala	Leu
1760						1765					1770			
Leu	Ile	Thr	Leu	Cys	Asp	Ala	Glu	Phe	Lys	Asp	Arg	Asp	Asp	Phe
1775						1780					1785			

Phe Lys	Met Val Ile Leu Trp	Arg Lys His Val Leu	Ser Cys Arg
1790	1795	1800	
Ile Cys	Thr Thr Tyr Gly Thr	Asp Leu Tyr Leu Phe	Ala Lys Tyr
1805	1810	1815	
His Ala	Lys Asp Cys Asn Val	Lys Leu Pro Phe Phe	Val Arg Ser
1820	1825	1830	
Val Ala	Thr Phe Ile Met Gln	Gly Ser Lys Leu Ser	Gly Ser Glu
1835	1840	1845	
Cys Tyr	Ile Leu Leu Thr Leu	Gly His His Asn Asn	Leu Pro Cys
1850	1855	1860	
His Gly	Glu Ile Gln Asn Ser	Lys Met Lys Ile Ala	Val Cys Asn
1865	1870	1875	
Asp Phe	Tyr Ala Ala Lys Lys	Leu Asp Asn Lys Ser	Ile Glu Ala
1880	1885	1890	
Asn Cys	Lys Ser Leu Leu Ser	Gly Leu Arg Ile Pro	Ile Asn Lys
1895	1900	1905	
Lys Glu	Leu Asn Arg Gln Arg	Arg Leu Leu Thr Leu	Gln Ser Asn
1910	1915	1920	
His Ser	Ser Val Ala Thr Val	Gly Gly Ser Lys Val	Ile Glu Ser
1925	1930	1935	
Lys Trp	Leu Thr Asn Lys Ala	Asn Thr Ile Ile Asp	Trp Leu Glu
1940	1945	1950	
His Ile	Leu Asn Ser Pro Lys	Gly Glu Leu Asn Tyr	Asp Phe Phe
1955	1960	1965	
Glu Ala	Leu Glu Asn Thr Tyr	Pro Asn Met Ile Lys	Leu Ile Asp
1970	1975	1980	
Asn Leu	Gly Asn Ala Glu Ile	Lys Lys Leu Ile Lys	Val Thr Gly
1985	1990	1995	
Tyr Met	Leu Val Ser Lys Lys		
2000	2005		



<210> 13  
 <211> 2165  
 <212> PRT  
 <213> human respiratory syncytial virus strain A2

<400> 13

Met Asp Pro Ile Ile Asn Gly Asn Ser Ala Asn Val Tyr Leu Thr Asp  
 1 5 10 15

Ser Tyr Leu Lys Gly Val Ile Ser Phe Ser Glu Cys Asn Ala Leu Gly  
 20 25 30

Ser Tyr Ile Phe Asn Gly Pro Tyr Leu Lys Asn Asp Tyr Thr Asn Leu  
 35 40 45

Ile Ser Arg Gln Asn Pro Leu Ile Glu His Met Asn Leu Lys Lys Leu  
 50 55 60

Asn Ile Thr Gln Ser Leu Ile Ser Lys Tyr His Lys Gly Glu Ile Lys  
 65 70 75 80

Leu Glu Glu Pro Thr Tyr Phe Gln Ser Leu Leu Met Thr Tyr Lys Ser  
 85 90 95

Met Thr Ser Ser Glu Gln Ile Ala Thr Thr Asn Leu Leu Lys Lys Ile  
 100 105 110

Ile Arg Arg Ala Ile Glu Ile Ser Asp Val Lys Val Tyr Ala Ile Leu  
 115 120 125

Asn Lys Leu Gly Leu Lys Glu Lys Asp Lys Ile Lys Ser Asn Asn Gly  
 130 135 140

Gln Asp Glu Asp Asn Ser Val Ile Thr Thr Ile Ile Lys Asp Asp Ile  
 145 150 155 160

Leu Ser Ala Val Lys Asp Asn Gln Ser His Leu Lys Ala Asp Lys Asn  
 165 170 175

His Ser Thr Lys Gln Lys Asp Thr Ile Lys Thr Thr Leu Leu Lys Lys  
 180 185 190

Leu Met Cys Ser Met Gln His Pro Pro Ser Trp Leu Ile His Trp Phe  
 195 200 205

Asn Leu Tyr Thr Lys Leu Asn Asn Ile Leu Thr Gln Tyr Arg Ser Asn

210	215	220
Glu Val Lys Asn His Gly Phe Thr Leu Ile Asp Asn Gln Thr Leu Ser		
225	230	235 240
Gly Phe Gln Phe Ile Leu Asn Gln Tyr Gly Cys Ile Val Tyr His Lys		
	245	250 255
Glu Leu Lys Arg Ile Thr Val Thr Thr Tyr Asn Gln Phe Leu Thr Trp		
	260	265 270
Lys Asp Ile Ser Leu Ser Arg Leu Asn Val Cys Leu Ile Thr Trp Ile		
	275	280 285
Ser Asn Cys Leu Asn Thr Leu Asn Lys Ser Leu Gly Leu Arg Cys Gly		
	290	295 300
Phe Asn Asn Val Ile Leu Thr Gln Leu Phe Leu Tyr Gly Asp Cys Ile		
305	310	315 320
Leu Lys Leu Phe His Asn Glu Gly Phe Tyr Ile Ile Lys Glu Val Glu		
	325	330 335
Gly Phe Ile Met Ser Leu Ile Leu Asn Ile Thr Glu Glu Asp Gln Phe		
	340	345 350
Arg Lys Arg Phe Tyr Asn Ser Met Leu Asn Asn Ile Thr Asp Ala Ala		
	355	360 365
Asn Lys Ala Gln Lys Asn Leu Leu Ser Arg Val Cys His Thr Leu Leu		
	370	375 380
Asp Lys Thr Val Ser Asp Asn Ile Ile Asn Gly Arg Trp Ile Ile Leu		
385	390	395 400
Leu Ser Lys Phe Leu Lys Leu Ile Lys Leu Ala Gly Asp Asn Asn Leu		
	405	410 415
Asn Asn Leu Ser Glu Leu Tyr Phe Leu Phe Arg Ile Phe Gly His Pro		
	420	425 430
Met Val Asp Glu Arg Gln Ala Met Asp Ala Val Lys Ile Asn Cys Asn		
	435	440 445
Glu Thr Lys Phe Tyr Leu Leu Ser Ser Leu Ser Met Leu Arg Gly Ala		

450

455

460

Phe Ile Tyr Arg Ile Ile Lys Gly Phe Val Asn Asn Tyr Asn Arg Trp  
 465 470 475 480

Pro Thr Leu Arg Asn Ala Ile Val Leu Pro Leu Arg Trp Leu Thr Tyr  
 485 490 495

Tyr Lys Leu Asn Thr Tyr Pro Ser Leu Leu Glu Leu Thr Glu Arg Asp  
 500 505 510

Leu Ile Val Leu Ser Gly Leu Arg Phe Tyr Arg Glu Phe Arg Leu Pro  
 515 520 525

Lys Lys Val Asp Leu Glu Met Ile Ile Asn Asp Lys Ala Ile Ser Pro  
 530 535 540

Pro Lys Asn Leu Ile Trp Thr Ser Phe Pro Arg Asn Tyr Met Pro Ser  
 545 550 555 560

His Ile Gln Asn Tyr Ile Glu His Glu Lys Leu Lys Phe Ser Glu Ser  
 565 570 575

Asp Lys Ser Arg Arg Val Leu Glu Tyr Tyr Leu Arg Asp Asn Lys Phe  
 580 585 590

Asn Glu Cys Asp Leu Tyr Asn Cys Val Val Asn Gln Ser Tyr Leu Asn  
 595 600 605

Asn Pro Asn His Val Val Ser Leu Thr Gly Lys Glu Arg Glu Leu Ser  
 610 615 620

Val Gly Arg Met Phe Ala Met Gln Pro Gly Met Phe Arg Gln Val Gln  
 625 630 635 640

Ile Leu Ala Glu Lys Met Ile Ala Glu Asn Ile Leu Gln Phe Phe Pro  
 645 650 655

Glu Ser Leu Thr Arg Tyr Gly Asp Leu Glu Leu Gln Lys Ile Leu Glu  
 660 665 670

Leu Lys Ala Gly Ile Ser Asn Lys Ser Asn Arg Tyr Asn Asp Asn Tyr  
 675 680 685

Asn Asn Tyr Ile Ser Lys Cys Ser Ile Ile Thr Asp Leu Ser Lys Phe

690

695

700

Asn Gln Ala Phe Arg Tyr Glu Thr Ser Cys Ile Cys Ser Asp Val Leu  
705 710 715 720

Asp Glu Leu His Gly Val Gln Ser Leu Phe Ser Trp Leu His Leu Thr  
725 730 735

Ile Pro His Val Thr Ile Ile Cys Thr Tyr Arg His Ala Pro Pro Tyr  
740 745 750

Ile Gly Asp His Ile Val Asp Leu Asn Asn Val Asp Glu Gln Ser Gly  
755 760 765

Leu Tyr Arg Tyr His Met Gly Gly Ile Glu Gly Trp Cys Gln Lys Leu  
770 775 780

Trp Thr Ile Glu Ala Ile Ser Leu Leu Asp Leu Ile Ser Leu Lys Gly  
785 790 795 800

Lys Phe Ser Ile Thr Ala Leu Ile Asn Gly Asp Asn Gln Ser Ile Asp  
805 810 815

Ile Ser Lys Pro Ile Arg Leu Met Glu Gly Gln Thr His Ala Gln Ala  
820 825 830

Asp Tyr Leu Leu Ala Leu Asn Ser Leu Lys Leu Leu Tyr Lys Glu Tyr  
835 840 845

Ala Gly Ile Gly His Lys Leu Lys Gly Thr Glu Thr Tyr Ile Ser Arg  
850 855 860

Asp Met Gln Phe Met Ser Lys Thr Ile Gln His Asn Gly Val Tyr Tyr  
865 870 875 880

Pro Ala Ser Ile Lys Lys Val Leu Arg Val Gly Pro Trp Ile Asn Thr  
885 890 895

Ile Leu Asp Asp Phe Lys Val Ser Leu Glu Ser Ile Gly Ser Leu Thr  
900 905 910

Gln Glu Leu Glu Tyr Arg Gly Glu Ser Leu Leu Cys Ser Leu Ile Phe  
915 920 925

Arg Asn Val Trp Leu Tyr Asn Gln Ile Ala Leu Gln Leu Lys Asn His

930

935

940

Ala Leu Cys Asn Asn Lys Leu Tyr Leu Asp Ile Leu Lys Val Leu Lys  
 945 950 955 960

His Leu Lys Thr Phe Phe Asn Leu Asp Asn Ile Asp Thr Ala Leu Thr  
 965 970 975

Leu Tyr Met Asn Leu Pro Met Leu Phe Gly Gly Gly Asp Pro Asn Leu  
 980 985 990

Leu Tyr Arg Ser Phe Tyr Arg Arg Thr Pro Asp Phe Leu Thr Glu Ala  
 995 1000 1005

Ile Val His Ser Val Phe Ile Leu Ser Tyr Tyr Thr Asn His Asp  
 1010 1015 1020

Leu Lys Asp Lys Leu Gln Asp Leu Ser Asp Asp Arg Leu Asn Lys  
 1025 1030 1035

Phe Leu Thr Cys Ile Ile Thr Phe Asp Lys Asn Pro Asn Ala Glu  
 1040 1045 1050

Phe Val Thr Leu Met Arg Asp Pro Gln Ala Leu Gly Ser Glu Arg  
 1055 1060 1065

Gln Ala Lys Ile Thr Ser Glu Ile Asn Arg Leu Ala Val Thr Glu  
 1070 1075 1080

Val Leu Ser Thr Ala Pro Asn Lys Ile Phe Ser Lys Ser Ala Gln  
 1085 1090 1095

His Tyr Thr Thr Thr Glu Ile Asp Leu Asn Asp Ile Met Gln Asn  
 1100 1105 1110

Ile Glu Pro Thr Tyr Pro His Gly Leu Arg Val Val Tyr Glu Ser  
 1115 1120 1125

Leu Pro Phe Tyr Lys Ala Glu Lys Ile Val Asn Leu Ile Ser Gly  
 1130 1135 1140

Thr Lys Ser Ile Thr Asn Ile Leu Glu Lys Thr Ser Ala Ile Asp  
 1145 1150 1155

Leu Thr Asp Ile Asp Arg Ala Thr Glu Met Met Arg Lys Asn Ile

1160	1165	1170
Thr Leu Leu Ile Arg Ile Leu 1175	Pro Leu Asp Cys Asn 1180	Arg Asp Lys 1185
Arg Glu Ile Leu Ser Met Glu 1190	Asn Leu Ser Ile Thr 1195	Glu Leu Ser 1200
Lys Tyr Val Arg Glu Arg Ser 1205	Trp Ser Leu Ser Asn 1210	Ile Val Gly 1215
Val Thr Ser Pro Ser Ile Met 1220	Tyr Thr Met Asp Ile 1225	Lys Tyr Thr 1230
Thr Ser Thr Ile Ser Ser Gly 1235	Ile Ile Ile Glu Lys 1240	Tyr Asn Val 1245
Asn Ser Leu Thr Arg Gly Glu 1250	Arg Gly Pro Thr Lys 1255	Pro Trp Val 1260
Gly Ser Ser Thr Gln Glu Lys 1265	Lys Thr Met Pro Val 1270	Tyr Asn Arg 1275
Gln Val Leu Thr Lys Lys Gln 1280	Arg Asp Gln Ile Asp 1285	Leu Leu Ala 1290
Lys Leu Asp Trp Val Tyr Ala 1295	Ser Ile Asp Asn Lys 1300	Asp Glu Phe 1305
Met Glu Glu Leu Ser Ile Gly 1310	Thr Leu Gly Leu Thr 1315	Tyr Glu Lys 1320
Ala Lys Lys Leu Phe Pro Gln 1325	Tyr Leu Ser Val Asn 1330	Tyr Leu His 1335
Arg Leu Thr Val Ser Ser Arg 1340	Pro Cys Glu Phe Pro 1345	Ala Ser Ile 1350
Pro Ala Tyr Arg Thr Thr Asn 1355	Tyr His Phe Asp Thr 1360	Ser Pro Ile 1365
Asn Arg Ile Leu Thr Glu Lys 1370	Tyr Gly Asp Glu Asp 1375	Ile Asp Ile 1380
Val Phe Gln Asn Cys Ile Ser	Phe Gly Leu Ser Leu	Met Ser Val

1385		1390		1395
Val Glu Gln Phe Thr Asn	Val Cys Pro Asn Arg	Ile Ile Leu Ile		
1400	1405	1410		
Pro Lys Leu Asn Glu Ile	His Leu Met Lys Pro	Pro Ile Phe Thr		
1415	1420	1425		
Gly Asp Val Asp Ile His	Lys Leu Lys Gln Val	Ile Gln Lys Gln		
1430	1435	1440		
His Met Phe Leu Pro Asp	Lys Ile Ser Leu Thr	Gln Tyr Val Glu		
1445	1450	1455		
Leu Phe Leu Ser Asn Lys	Thr Leu Lys Ser Gly	Ser His Val Asn		
1460	1465	1470		
Ser Asn Leu Ile Leu Ala	His Lys Ile Ser Asp	Tyr Phe His Asn		
1475	1480	1485		
Thr Tyr Ile Leu Ser Thr	Asn Leu Ala Gly His	Trp Ile Leu Ile		
1490	1495	1500		
Ile Gln Leu Met Lys Asp	Ser Lys Gly Ile Phe	Glu Lys Asp Trp		
1505	1510	1515		
Gly Glu Gly Tyr Ile Thr	Asp His Met Phe Ile	Asn Leu Lys Val		
1520	1525	1530		
Phe Phe Asn Ala Tyr Lys	Thr Tyr Leu Leu Cys	Phe His Lys Gly		
1535	1540	1545		
Tyr Gly Lys Ala Lys Leu	Glu Cys Asp Met Asn	Thr Ser Asp Leu		
1550	1555	1560		
Leu Cys Val Leu Glu Leu	Ile Asp Ser Ser Tyr	Trp Lys Ser Met		
1565	1570	1575		
Ser Lys Val Phe Leu Glu	Gln Lys Val Ile Lys	Tyr Ile Leu Ser		
1580	1585	1590		
Gln Asp Ala Ser Leu His	Arg Val Lys Gly Cys	His Ser Phe Lys		
1595	1600	1605		
Leu Trp Phe Leu Lys Arg	Leu Asn Val Ala Glu	Phe Thr Val Cys		

1610	1615	1620
Pro Trp Val Val Asn Ile Asp Tyr His Pro Thr His Met Lys Ala		
1625	1630	1635
Ile Leu Thr Tyr Ile Asp Leu Val Arg Met Gly Leu Ile Asn Ile		
1640	1645	1650
Asp Arg Ile His Ile Lys Asn Lys His Lys Phe Asn Asp Glu Phe		
1655	1660	1665
Tyr Thr Ser Asn Leu Phe Tyr Ile Asn Tyr Asn Phe Ser Asp Asn		
1670	1675	1680
Thr His Leu Leu Thr Lys His Ile Arg Ile Ala Asn Ser Glu Leu		
1685	1690	1695
Glu Asn Asn Tyr Asn Lys Leu Tyr His Pro Thr Pro Glu Thr Leu		
1700	1705	1710
Glu Asn Ile Leu Ala Asn Pro Ile Lys Ser Asn Asp Lys Lys Thr		
1715	1720	1725
Leu Asn Asp Tyr Cys Ile Gly Lys Asn Val Asp Ser Ile Met Leu		
1730	1735	1740
Pro Leu Leu Ser Asn Lys Lys Leu Ile Lys Ser Ser Ala Met Ile		
1745	1750	1755
Arg Thr Asn Tyr Ser Lys Gln Asp Leu Tyr Asn Leu Phe Pro Met		
1760	1765	1770
Val Val Ile Asp Arg Ile Ile Asp His Ser Gly Asn Thr Ala Lys		
1775	1780	1785
Ser Asn Gln Leu Tyr Thr Thr Thr Ser His Gln Ile Ser Leu Val		
1790	1795	1800
His Asn Ser Thr Ser Leu Tyr Cys Met Leu Pro Trp His His Ile		
1805	1810	1815
Asn Arg Phe Asn Phe Val Phe Ser Ser Thr Gly Cys Lys Ile Ser		
1820	1825	1830
Ile Glu Tyr Ile Leu Lys Asp Leu Lys Ile Lys Asp Pro Asn Cys		



1835				1840				1845						
Ile	Ala	Phe	Ile	Gly	Glu	Gly	Ala	Gly	Asn	Leu	Leu	Leu	Arg	Thr
1850				1855				1860						
Val	Val	Glu	Leu	His	Pro	Asp	Ile	Arg	Tyr	Ile	Tyr	Arg	Ser	Leu
1865				1870				1875						
Lys	Asp	Cys	Asn	Asp	His	Ser	Leu	Pro	Ile	Glu	Phe	Leu	Arg	Leu
1880				1885				1890						
Tyr	Asn	Gly	His	Ile	Asn	Ile	Asp	Tyr	Gly	Glu	Asn	Leu	Thr	Ile
1895				1900				1905						
Pro	Ala	Thr	Asp	Ala	Thr	Asn	Asn	Ile	His	Trp	Ser	Tyr	Leu	His
1910				1915				1920						
Ile	Lys	Phe	Ala	Glu	Pro	Ile	Ser	Leu	Phe	Val	Cys	Asp	Ala	Glu
1925				1930				1935						
Leu	Ser	Val	Thr	Val	Asn	Trp	Ser	Lys	Ile	Ile	Ile	Glu	Trp	Ser
1940				1945				1950						
Lys	His	Val	Arg	Lys	Cys	Lys	Tyr	Cys	Ser	Ser	Val	Asn	Lys	Cys
1955				1960				1965						
Met	Leu	Ile	Val	Lys	Tyr	His	Ala	Gln	Asp	Asp	Ile	Asp	Phe	Lys
1970				1975				1980						
Leu	Asp	Asn	Ile	Thr	Ile	Leu	Lys	Thr	Tyr	Val	Cys	Leu	Gly	Ser
1985				1990				1995						
Lys	Leu	Lys	Gly	Ser	Glu	Val	Tyr	Leu	Val	Leu	Thr	Ile	Gly	Pro
2000				2005				2010						
Ala	Asn	Ile	Phe	Pro	Val	Phe	Asn	Val	Val	Gln	Asn	Ala	Lys	Leu
2015				2020				2025						
Ile	Leu	Ser	Arg	Thr	Lys	Asn	Phe	Ile	Met	Pro	Lys	Lys	Ala	Asp
2030				2035				2040						
Lys	Glu	Ser	Ile	Asp	Ala	Asn	Ile	Lys	Ser	Leu	Ile	Pro	Phe	Leu
2045				2050				2055						
Cys	Tyr	Pro	Ile	Thr	Lys	Lys	Gly	Ile	Asn	Thr	Ala	Leu	Ser	Lys

2060

2065

2070

Leu Lys Ser Val Val Ser Gly Asp Ile Leu Ser Tyr Ser Ile Ala  
 2075 2080 2085

Gly Arg Asn Glu Val Phe Ser Asn Lys Leu Ile Asn His Lys His  
 2090 2095 2100

Met Asn Ile Leu Lys Trp Phe Asn His Val Leu Asn Phe Arg Ser  
 2105 2110 2115

Thr Glu Leu Asn Tyr Asn His Leu Tyr Met Val Glu Ser Thr Tyr  
 2120 2125 2130

Pro Tyr Leu Ser Glu Leu Leu Asn Ser Leu Thr Thr Asn Glu Leu  
 2135 2140 2145

Lys Lys Leu Ile Lys Ile Thr Gly Ser Leu Leu Tyr Asn Phe His  
 2150 2155 2160

Asn Glu  
 2165

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 <213> human parainfluenza virus 3

<400> 14

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Glu Cys His Leu Asn Ser Pro Ile Val Lys Gly Lys Ile Ala Gln Leu  
 20 25 30

His Thr Ile Met Ser Leu Pro Gln Pro Tyr Asp Met Asp Asp Asp Ser  
 35 40 45

Ile Leu Val Ile Thr Arg Gln Lys Ile Lys Leu Asn Lys Leu Asp Lys  
 50 55 60

Arg Gln Arg Ser Ile Arg Arg Leu Lys Leu Ile Leu Thr Glu Lys Val  
 65 70 75 80

Asn Asp Leu Gly Lys Tyr Thr Phe Ile Arg Tyr Pro Glu Met Ser Lys  
 85 90 95

Glu Met Phe Lys Leu His Ile Pro Gly Ile Asn Ser Lys Val Thr Glu  
100 105 110

Leu Leu Leu Lys Ala Asp Arg Thr Tyr Ser Gln Met Thr Asp Gly Leu  
115 120 125

Arg Asp Leu Trp Ile Asn Val Leu Ser Lys Leu Ala Ser Lys Asn Asp  
130 135 140

Gly Ser Asn Tyr Asp Leu Asn Glu Glu Ile Asn Asn Ile Ser Lys Val  
145 150 155 160

His Thr Thr Tyr Lys Ser Asp Lys Trp Tyr Asn Pro Phe Lys Thr Trp  
165 170 175

Phe Thr Ile Lys Tyr Asp Met Arg Arg Leu Gln Lys Ala Arg Asn Glu  
180 185 190

Val Thr Phe Asn Met Gly Lys Asp Tyr Asn Leu Leu Glu Asp Gln Lys  
195 200 205

Asn Phe Leu Leu Ile His Pro Glu Leu Val Leu Ile Leu Asp Lys Gln  
210 215 220

Asn Tyr Asn Gly Tyr Leu Ile Thr Pro Glu Leu Val Leu Pro Tyr Cys  
225 230 235 240

Asp Val Val Glu Gly Arg Trp Asn Ile Ser Ala Cys Ala Lys Leu Asp  
245 250 255

Pro Lys Leu Gln Ser Met Tyr Gln Lys Gly Asn Asn Leu Trp Glu Val  
260 265 270

Ile Asp Lys Leu Phe Pro Ile Met Gly Glu Lys Thr Phe Asp Val Ile  
275 280 285

Ser Leu Leu Glu Pro Leu Ala Leu Ser Leu Ile Gln Thr His Asp Pro  
290 295 300

Val Lys Gln Leu Arg Gly Ala Phe Leu Asn His Val Leu Ser Glu Met  
305 310 315 320

Glu Leu Ile Phe Glu Ser Arg Glu Ser Ile Lys Glu Phe Leu Ser Val  
325 330 335

Asp Tyr Ile Asp Lys Ile Leu Asp Ile Phe Asn Lys Ser Thr Ile Asp  
340 345 350

Glu Ile Ala Glu Ile Phe Ser Phe Phe Arg Thr Phe Gly His Pro Pro  
355 360 365

Leu Glu Ala Ser Ile Ala Ala Glu Lys Val Arg Lys Tyr Met Tyr Ile  
370 375 380

Gly Lys Gln Leu Lys Phe Asp Thr Ile Asn Lys Cys His Ala Ile Phe  
385 390 395 400

Cys Thr Ile Ile Ile Asn Gly Tyr Arg Glu Arg His Gly Gly Gln Trp  
405 410 415

Pro Pro Val Thr Leu Pro Asp His Ala His Glu Phe Ile Ile Asn Ala  
420 425 430

Tyr Gly Ser Asn Ser Ala Ile Ser Tyr Glu Asn Ala Val Asp Tyr Tyr  
435 440 445

Gln Ser Phe Ile Gly Ile Lys Phe Asn Lys Phe Ile Glu Pro Gln Leu  
450 455 460

Asp Glu Asp Leu Thr Ile Tyr Met Lys Asp Lys Ala Leu Ser Pro Lys  
465 470 475 480

Lys Ser Asn Trp Asp Thr Val Ser Pro Ala Ser Asn Leu Leu Tyr Arg  
485 490 495

Thr Asn Ala Ser Asn Glu Ser Arg Arg Leu Val Glu Lys Phe Ile Ala  
500 505 510

Asp Ser Lys Phe Asp Pro Asn Gln Ile Leu Asp Tyr Val Glu Ser Gly  
515 520 525

Asp Trp Leu Asp Asp Pro Glu Phe Asn Ile Ser Tyr Ser Leu Lys Glu  
530 535 540

Lys Glu Ile Lys Gln Glu Gly Arg Leu Phe Ala Lys Met Thr Tyr Lys  
545 550 555 560

Met Arg Ala Thr Gln Val Leu Ser Glu Thr Leu Leu Ala Asn Asn Ile  
565 570 575

Gly Lys Phe Phe Gln Glu Asn Gly Met Val Lys Gly Glu Ile Glu Leu  
580 585 590

Leu Lys Arg Leu Thr Thr Ile Ser Ile Ser Gly Val Pro Arg Tyr Asn  
595 600 605

Glu Val Tyr Asn Asn Ser Lys Ser His Thr Asp Asp Leu Lys Thr Tyr  
610 615 620

Asn Lys Ile Ser Asn Leu Asn Leu Ser Ser Asn Gln Lys Ser Lys Lys  
625 630 635 640

Phe Glu Phe Lys Ser Thr Asp Ile Tyr Asn Asp Gly Tyr Glu Thr Val  
645 650 655

Ser Cys Phe Leu Thr Thr Asp Leu Lys Lys Tyr Cys Leu Asn Trp Arg  
660 665 670

Tyr Glu Ser Thr Ala Leu Phe Gly Glu Thr Cys Asn Gln Ile Phe Gly  
675 680 685

Leu Asn Lys Leu Phe Asn Trp Leu His Pro Arg Leu Glu Gly Ser Thr  
690 695 700

Ile Tyr Val Gly Asp Pro Tyr Cys Pro Pro Ser Asp Lys Glu His Ile  
705 710 715 720

Ser Leu Glu Asp His Pro Asp Ser Gly Phe Tyr Val His Asn Pro Arg  
725 730 735

Gly Gly Ile Glu Gly Phe Cys Gln Lys Leu Trp Thr Leu Ile Ser Ile  
740 745 750

Ser Ala Ile His Leu Ala Ala Val Arg Ile Gly Val Arg Val Thr Ala  
755 760 765

Met Val Gln Gly Asp Asn Gln Ala Ile Ala Val Thr Thr Arg Val Pro  
770 775 780

Asn Asn Tyr Asp Tyr Arg Val Lys Lys Glu Ile Val Tyr Lys Asp Val  
785 790 795 800

Val Arg Phe Phe Asp Ser Leu Arg Glu Val Met Asp Asp Leu Gly His  
805 810 815

Glu Leu Lys Leu Asn Glu Thr Ile Ile Ser Ser Lys Met Phe Ile Tyr  
820 825 830

Ser Lys Arg Ile Tyr Tyr Asp Gly Arg Ile Leu Pro Gln Ala Leu Lys  
835 840 845

Ala Leu Ser Arg Cys Val Phe Trp Ser Glu Thr Val Ile Asp Glu Thr  
850 855 860

Arg Ser Ala Ser Ser Asn Leu Ala Thr Ser Phe Ala Lys Ala Ile Glu  
865 870 875 880

Asn Gly Tyr Ser Pro Val Leu Gly Tyr Ala Cys Ser Ile Phe Lys Asn  
885 890 895

Ile Gln Gln Leu Tyr Ile Ala Leu Gly Met Asn Ile Asn Pro Thr Ile  
900 905 910

Thr Gln Asn Ile Lys Asp Leu Tyr Phe Arg Asn Pro Asn Trp Met Gln  
915 920 925

Tyr Ala Ser Leu Ile Pro Ala Ser Val Gly Gly Phe Asn Tyr Met Ala  
930 935 940

Met Ser Arg Cys Phe Val Arg Asn Ile Gly Asp Pro Ser Val Ala Ala  
945 950 955 960

Leu Ala Asp Ile Lys Arg Phe Ile Lys Ala Asn Leu Leu Asp Arg Ser  
965 970 975

Val Leu Tyr Arg Ile Met Asn Gln Glu Pro Gly Glu Ser Ser Phe Leu  
980 985 990

Asp Trp Ala Ser Asp Pro Tyr Ser Cys Asn Leu Pro Gln Ser Gln Asn  
995 1000 1005

Ile Thr Thr Met Ile Lys Asn Ile Thr Ala Arg Asn Val Leu Gln  
1010 1015 1020

Asp Ser Pro Asn Pro Leu Leu Ser Gly Leu Phe Thr Asn Thr Met  
1025 1030 1035

Ile Glu Glu Asp Glu Glu Leu Ala Glu Phe Leu Met Asp Arg Lys  
1040 1045 1050

Val	Ile	Leu	Pro	Arg	Val	Ala	His	Asp	Ile	Leu	Asp	Asn	Ser	Leu
1055						1060					1065			
Thr	Gly	Ile	Arg	Asn	Ala	Ile	Ala	Gly	Met	Leu	Asp	Thr	Thr	Lys
1070						1075					1080			
Ser	Leu	Ile	Arg	Val	Gly	Ile	Asn	Arg	Gly	Gly	Leu	Thr	Tyr	Ser
1085						1090					1095			
Leu	Leu	Arg	Lys	Ile	Ser	Asn	Tyr	Asp	Leu	Val	Gln	Tyr	Glu	Thr
1100						1105					1110			
Leu	Ser	Arg	Thr	Leu	Arg	Leu	Ile	Val	Ser	Asp	Lys	Ile	Arg	Tyr
1115						1120					1125			
Glu	Asp	Met	Cys	Ser	Val	Asp	Leu	Ala	Ile	Ala	Leu	Arg	Gln	Lys
1130						1135					1140			
Met	Trp	Ile	His	Leu	Ser	Gly	Gly	Arg	Met	Ile	Ser	Gly	Leu	Glu
1145						1150					1155			
Thr	Pro	Asp	Pro	Leu	Glu	Leu	Leu	Ser	Gly	Val	Ile	Ile	Thr	Gly
1160						1165					1170			
Ser	Glu	His	Cys	Lys	Ile	Cys	Tyr	Ser	Ser	Asp	Gly	Thr	Asn	Pro
1175						1180					1185			
Tyr	Thr	Trp	Met	Tyr	Leu	Pro	Gly	Asn	Ile	Lys	Ile	Gly	Ser	Ala
1190						1195					1200			
Glu	Thr	Gly	Ile	Ser	Ser	Leu	Arg	Val	Pro	Tyr	Phe	Gly	Ser	Val
1205						1210					1215			
Thr	Asp	Glu	Arg	Ser	Glu	Ala	Gln	Leu	Gly	Tyr	Ile	Lys	Asn	Leu
1220						1225					1230			
Ser	Lys	Pro	Ala	Lys	Ala	Ala	Ile	Arg	Ile	Ala	Met	Ile	Tyr	Thr
1235						1240					1245			
Trp	Ala	Phe	Gly	Asn	Asp	Glu	Ile	Ser	Trp	Met	Glu	Ala	Ser	Gln
1250						1255					1260			
Ile	Ala	Gln	Thr	Arg	Ala	Asn	Phe	Thr	Leu	Asp	Ser	Leu	Lys	Ile
1265						1270					1275			

Leu Thr	Pro Val	Ala Thr	Ser	Thr Asn	Leu Ser	His	Arg Leu	Lys
1280			1285			1290		
Asp Thr	Ala Thr	Gln Met	Lys	Phe Ser	Ser Thr	Ser	Leu Ile	Arg
1295			1300			1305		
Val Ser	Arg Phe	Ile Thr	Met	Ser Asn	Asp Asn	Met	Ser Ile	Lys
1310			1315			1320		
Glu Ala	Asn Glu	Thr Lys	Asp	Thr Asn	Leu Ile	Tyr	Gln Gln	Ile
1325			1330			1335		
Met Leu	Thr Gly	Leu Ser	Val	Phe Glu	Tyr Leu	Phe	Arg Leu	Glu
1340			1345			1350		
Glu Thr	Thr Gly	His Asn	Pro	Ile Val	Met His	Leu	His Ile	Glu
1355			1360			1365		
Asp Glu	Cys Cys	Ile Lys	Glu	Ser Phe	Asn Asp	Glu	His Ile	Asn
1370			1375			1380		
Pro Glu	Ser Thr	Leu Glu	Leu	Ile Arg	Tyr Pro	Glu	Ser Asn	Glu
1385			1390			1395		
Phe Ile	Tyr Asp	Lys Asp	Pro	Leu Lys	Asp Val	Asp	Leu Ser	Lys
1400			1405			1410		
Leu Met	Val Ile	Lys Asp	His	Ser Tyr	Thr Ile	Asp	Met Asn	Tyr
1415			1420			1425		
Trp Asp	Asp Thr	Asp Ile	Ile	His Ala	Ile Ser	Ile	Cys Thr	Ala
1430			1435			1440		
Ile Thr	Ile Ala	Asp Thr	Met	Ser Gln	Leu Asp	Arg	Asp Asn	Leu
1445			1450			1455		
Lys Glu	Ile Ile	Val Ile	Ala	Asn Asp	Asp Asp	Ile	Asn Ser	Leu
1460			1465			1470		
Ile Thr	Glu Phe	Leu Thr	Leu	Asp Ile	Leu Val	Phe	Leu Lys	Thr
1475			1480			1485		
Phe Gly	Gly Leu	Leu Val	Asn	Gln Phe	Ala Tyr	Thr	Leu Tyr	Ser
1490			1495			1500		



Leu Lys Thr Glu Gly Arg Asp	Leu Ile Trp Asp Tyr Ile Met Arg
1505	1510 1515
Thr Leu Arg Asp Thr Ser His	Ser Ile Leu Lys Val Leu Ser Asn
1520	1525 1530
Ala Leu Ser His Pro Lys Val	Phe Lys Arg Phe Trp Asp Cys Gly
1535	1540 1545
Val Leu Asn Pro Ile Tyr Gly	Pro Asn Thr Ala Ser Gln Asp Gln
1550	1555 1560
Ile Lys Leu Ala Leu Ser Ile	Cys Glu Tyr Ser Leu Asp Leu Phe
1565	1570 1575
Met Arg Glu Trp Leu Asn Gly	Val Ser Leu Glu Ile Tyr Ile Cys
1580	1585 1590
Asp Ser Asp Met Glu Val Ala	Asn Asp Arg Lys Gln Ala Phe Ile
1595	1600 1605
Ser Arg His Leu Ser Phe Val	Cys Cys Leu Ala Glu Ile Ala Ser
1610	1615 1620
Phe Gly Pro Asn Leu Leu Asn	Leu Thr Tyr Leu Glu Arg Leu Asp
1625	1630 1635
Leu Leu Lys Gln Tyr Leu Glu	Leu Asn Ile Lys Asp Asp Pro Thr
1640	1645 1650
Leu Lys Tyr Val Gln Ile Ser	Gly Leu Leu Ile Lys Ser Phe Pro
1655	1660 1665
Ser Thr Val Thr Tyr Val Arg	Lys Thr Ala Ile Lys Tyr Leu Arg
1670	1675 1680
Ile Arg Gly Ile Ser Pro Pro	Glu Val Ile Asp Asp Trp Asp Pro
1685	1690 1695
Ile Glu Asp Glu Asn Met Leu	Asp Asn Ile Val Lys Thr Ile Asn
1700	1705 1710
Asp Asn Cys Asn Lys Asp Asn	Lys Gly Asn Lys Ile Asn Asn Phe
1715	1720 1725

Trp Gly	Leu Ala	Leu Lys	Asn	Tyr Gln	Val Leu	Lys	Ile Arg	Ser	
1730			1735			1740			
Ile Thr	Ser Asp	Ser Asp	Asn	Asn Asp	Arg Ser	Asp	Ala Ser	Thr	
1745			1750			1755			
Gly Gly	Leu Thr	Leu Pro	Gln	Gly Gly	Asn Tyr	Leu	Ser His	Gln	
1760			1765			1770			
Leu Arg	Leu Phe	Gly Ile	Asn	Ser Thr	Ser Cys	Leu	Lys Ala	Leu	
1775			1780			1785			
Glu Leu	Ser Gln	Ile Leu	Met	Lys Glu	Val Asn	Lys	Asp Gln	Asp	
1790			1795			1800			
Arg Leu	Phe Leu	Gly Glu	Gly	Ala Gly	Ala Met	Leu	Ala Cys	Tyr	
1805			1810			1815			
Asp Ala	Thr Leu	Gly Pro	Ala	Val Asn	Tyr Tyr	Asn	Ser Gly	Leu	
1820			1825			1830			
Asn Ile	Thr Asp	Val Ile	Gly	Gln Arg	Glu Leu	Lys	Ile Phe	Pro	
1835			1840			1845			
Ser Glu	Val Ser	Leu Val	Gly	Lys Lys	Leu Gly	Asn	Val Thr	Gln	
1850			1855			1860			
Ile Leu	Asn Arg	Val Lys	Val	Leu Phe	Asn Gly	Asn	Pro Asn	Ser	
1865			1870			1875			
Thr Trp	Ile Gly	Asn Met	Glu	Cys Glu	Thr Leu	Ile	Trp Ser	Glu	
1880			1885			1890			
Leu Asn	Asp Lys	Ser Ile	Gly	Leu Val	His Cys	Asp	Met Glu	Gly	
1895			1900			1905			
Ala Ile	Gly Lys	Ser Glu	Glu	Thr Val	Leu His	Glu	His Tyr	Ser	
1910			1915			1920			
Val Ile	Arg Ile	Thr Tyr	Leu	Ile Gly	Asp Asp	Asp	Val Val	Leu	
1925			1930			1935			
Ile Ser	Lys Ile	Ile Pro	Thr	Ile Thr	Pro Asn	Trp	Ser Arg	Ile	
1940			1945			1950			

Leu Tyr 1955	Leu Tyr Lys Leu Tyr 1960	Trp Lys Asp Val Ser 1965	Ile Ile Ser
Leu Lys 1970	Thr Ser Asn Pro Ala 1975	Ser Thr Glu Leu Tyr 1980	Leu Ile Ser
Lys Asp 1985	Ala Tyr Cys Thr Ile 1990	Met Glu Pro Ser Glu 1995	Val Val Leu
Ser Lys 2000	Leu Lys Arg Leu Ser 2005	Leu Leu Glu Glu Asn 2010	Asn Leu Leu
Lys Trp 2015	Ile Ile Leu Ser Lys 2020	Lys Lys Asn Asn Glu 2025	Trp Leu His
His Glu 2030	Ile Lys Glu Gly Glu 2035	Arg Asp Tyr Gly Val 2040	Met Arg Pro
Tyr His 2045	Met Ala Leu Gln Ile 2050	Phe Gly Phe Gln Ile 2055	Asn Leu Asn
His Leu 2060	Ala Lys Glu Phe Leu 2065	Ser Thr Pro Asp Leu 2070	Thr Asn Ile
Asn Asn 2075	Ile Ile Gln Ser Phe 2080	Gln Arg Thr Ile Lys 2085	Asp Val Leu
Phe Glu 2090	Trp Ile Asn Ile Thr 2095	His Asp Gly Lys Arg 2100	His Lys Leu
Gly Gly 2105	Arg Tyr Asn Ile Phe 2110	Pro Leu Lys Asn Lys 2115	Gly Lys Leu
Arg Leu 2120	Leu Ser Arg Arg Leu 2125	Val Leu Ser Trp Ile 2130	Ser Leu Ser
Leu Ser 2135	Thr Arg Leu Leu Thr 2140	Gly Arg Phe Pro Asp 2145	Glu Lys Phe
Glu His 2150	Arg Ala Gln Thr Gly 2155	Tyr Val Ser Leu Pro 2160	Asp Thr Asp
Leu Glu 2165	Ser Leu Lys Leu Leu 2170	Ser Lys Asn Thr Ile 2175	Lys Asn Tyr

Arg Glu Cys Ile Gly Ser Ile Ser Tyr Trp Phe Leu Thr Lys Glu  
 2180 2185 2190

Val Lys Ile Leu Met Lys Leu Ile Gly Gly Ala Lys Leu Leu Gly  
 2195 2200 2205

Ile Pro Arg Gln Tyr Lys Glu Pro Glu Glu Gln Leu Leu Glu Asp  
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Tyr Asn Gln His Asp Glu Phe Asp Ile Asp  
 2225 2230

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Glu Cys His Leu Asn Ser Pro Ile Val Lys Ser Lys Ile Ala Gln Leu  
 20 25 30

His Val Leu Leu Asp Ile Asn Gln Pro Tyr Asp Leu Lys Asp Asn Ser  
 35 40 45

Ile Ile Asn Ile Thr Lys Tyr Lys Ile Arg Asn Gly Gly Leu Ser Pro  
 50 55 60

Arg Gln Ile Lys Ile Arg Ser Leu Gly Lys Ile Leu Lys Gln Glu Ile  
 65 70 75 80

Lys Asp Ile Asp Arg Tyr Thr Phe Glu Pro Tyr Pro Ile Phe Ser Leu  
 85 90 95

Glu Leu Leu Arg Leu Asp Ile Pro Glu Ile Cys Asp Lys Ile Arg Ser  
 100 105 110

Ile Phe Ser Val Ser Asp Arg Leu Ile Arg Glu Leu Ser Ser Gly Phe  
 115 120 125

Gln Glu Leu Trp Leu Asn Ile Leu Arg Gln Leu Gly Cys Val Glu Gly  
 130 135 140

Lys Glu Gly Phe Asp Ser Leu Lys Asp Val Asp Ile Ile Pro Asp Ile  
 145 150 155 160

Thr Asp Lys Tyr Asn Lys Asn Thr Trp Tyr Arg Pro Phe Leu Thr Trp  
 165 170 175

Phe Ser Ile Lys Tyr Asp Met Arg Trp Met Gln Lys Asn Lys Ser Gly  
 180 185 190

Asn His Leu Asp Val Ser Asn Ser His Asn Phe Leu Asp Cys Lys Ser  
 195 200 205

Tyr Ile Leu Ile Ile Tyr Arg Asp Leu Val Ile Ile Ile Asn Lys Leu  
 210 215 220

Lys Leu Thr Gly Tyr Val Leu Thr Pro Glu Leu Val Leu Met Tyr Cys  
 225 230 235 240

Asp Val Val Glu Gly Arg Trp Asn Met Ser Ser Ala Gly Arg Leu Asp  
 245 250 255

Lys Arg Ser Ser Lys Ile Thr Cys Lys Gly Glu Glu Leu Trp Glu Leu  
 260 265 270

Ile Asp Ser Leu Phe Pro Asn Leu Gly Glu Asp Val Tyr Asn Ile Ile  
 275 280 285

Ser Leu Leu Glu Pro Leu Ser Leu Ala Leu Ile Gln Leu Asp Asp Pro  
 290 295 300

Val Thr Asn Leu Lys Gly Ala Phe Met Arg His Val Leu Thr Glu Leu  
 305 310 315 320

His Thr Ile Leu Ile Lys Asp Asn Ile Tyr Thr Asp Ser Glu Ala Asp  
 325 330 335

Ser Ile Met Glu Ser Leu Ile Lys Ile Phe Arg Glu Thr Ser Ile Asp  
 340 345 350

Glu Lys Ala Glu Ile Phe Ser Phe Phe Arg Thr Phe Gly His Pro Ser  
 355 360 365

Leu Glu Ala Ile Thr Ala Ala Asp Lys Val Arg Thr His Met Tyr Ser  
 370 375 380

Ser Lys Lys Ile Ile Leu Lys Thr Leu Tyr Glu Cys His Ala Ile Phe  
 385 390 395 400

Cys Ala Ile Ile Ile Asn Gly Tyr Arg Glu Arg His Gly Gly Gln Trp  
 405 410 415

Pro Pro Cys Glu Phe Pro Asn His Val Cys Leu Glu Leu Lys Asn Ala  
 420 425 430

Gln Gly Ser Asn Ser Ala Ile Ser Tyr Glu Cys Ala Val Asp Asn Tyr  
 435 440 445

Ser Ser Phe Ile Gly Phe Lys Phe Leu Lys Phe Ile Glu Pro Gln Leu  
 450 455 460

Asp Glu Asp Leu Thr Ile Tyr Met Lys Asp Lys Ala Leu Ser Pro Arg  
 465 470 475 480

-- Lys Ala Ala Trp Asp Ser Val Tyr Pro Asp Ser Asn Leu Tyr Tyr Lys  
 485 490 495

Val Pro Glu Ser Glu Glu Thr Arg Arg Leu Ile Glu Val Phe Ile Asn  
 500 505 510

Asp Asn Asn Phe Asn Pro Ala Asp Ile Ile Asn Tyr Val Glu Ser Gly  
 515 520 525

Glu Trp Leu Asn Asp Asp Ser Phe Asn Ile Ser Tyr Ser Leu Lys Glu  
 530 535 540

Lys Glu Ile Lys Gln Glu Gly Arg Leu Phe Ala Lys Met Thr Tyr Lys  
 545 550 555 560

Met Arg Ala Val Gln Val Leu Ala Glu Thr Leu Leu Ala Lys Gly Val  
 565 570 575

Gly Glu Leu Phe Ser Glu Asn Gly Met Val Lys Gly Glu Ile Asp Leu  
 580 585 590

Leu Lys Arg Leu Thr Thr Leu Ser Val Ser Gly Val Pro Arg Ser Asn  
 595 600 605

Ser Val Tyr Asn Asn Pro Ile Leu His Glu Lys Leu Ile Lys Asn Met  
 610 615 620

Asn Lys Cys Asn Ser Asn Gly Tyr Trp Asp Glu Arg Lys Lys Ser Lys  
625 630 635 640

Asn Glu Phe Lys Ala Ala Asp Ser Ser Thr Glu Gly Tyr Glu Thr Leu  
645 650 655

Ser Cys Phe Leu Thr Thr Asp Leu Lys Lys Tyr Cys Leu Asn Trp Arg  
660 665 670

Phe Glu Ser Thr Ala Leu Phe Gly Gln Arg Cys Asn Glu Ile Phe Gly  
675 680 685

Phe Lys Thr Phe Phe Asn Trp Met His Pro Ile Leu Glu Lys Ser Thr  
690 695 700

Ile Tyr Val Gly Asp Pro Tyr Cys Pro Val Pro Asp Arg Met His Lys  
705 710 715 720

Glu Leu Gln Asp His Asp Asp Thr Gly Ile Phe Ile His Asn Pro Arg  
725 730 735

Gly Gly Ile Glu Gly Tyr Cys Gln Lys Leu Trp Thr Leu Ile Ser Ile  
740 745 750

Ser Ala Ile His Leu Ala Ala Val Lys Val Gly Val Arg Val Ser Ala  
755 760 765

Met Val Gln Gly Asp Asn Gln Ala Ile Ala Val Thr Ser Arg Val Pro  
770 775 780

Val Thr Gln Thr Tyr Lys Gln Lys Lys Thr His Val Tyr Glu Glu Ile  
785 790 795 800

Thr Arg Tyr Phe Gly Ala Leu Arg Glu Val Met Phe Asp Ile Gly His  
805 810 815

Glu Leu Lys Leu Asn Glu Thr Ile Ile Ser Ser Lys Met Phe Val Tyr  
820 825 830

Ser Lys Arg Ile Tyr Tyr Asp Gly Lys Ile Leu Pro Gln Cys Leu Lys  
835 840 845

Ala Leu Thr Arg Cys Val Phe Trp Ser Glu Thr Leu Val Asp Glu Asn  
850 855 860

Arg Ser Ala Cys Ser Asn Ile Ala Thr Ser Ile Ala Lys Ala Ile Glu  
865 870 875 880

Asn Gly Tyr Ser Pro Ile Leu Gly Tyr Cys Ile Ala Leu Phe Lys Thr  
885 890 895

Cys Gln Gln Val Cys Ile Ser Leu Gly Met Thr Ile Asn Pro Thr Ile  
900 905 910

Thr Ser Thr Ile Lys Asp Gln Tyr Phe Lys Gly Lys Asn Trp Leu Arg  
915 920 925

Cys Ala Ile Leu Ile Pro Ala Asn Ile Gly Gly Phe Asn Tyr Met Ser  
930 935 940

Thr Ala Arg Cys Phe Val Arg Asn Ile Gly Asp Pro Ala Val Ala Ala  
945 950 955 960

Leu Ala Asp Leu Lys Arg Phe Ile Lys Ala Gly Leu Leu Asp Lys Gln  
965 970 975

Val Leu Tyr Arg Val Met Asn Gln Glu Pro Gly Asp Ser Ser Phe Leu  
980 985 990

Asp Trp Ala Ser Asp Pro Tyr Ser Cys Asn Leu Pro His Ser Gln Ser  
995 1000 1005

Ile Thr Thr Ile Ile Lys Asn Val Thr Ala Arg Ser Val Leu Gln  
1010 1015 1020

Glu Ser Pro Asn Pro Leu Leu Ser Gly Leu Phe Ser Glu Ser Ser  
1025 1030 1035

Ser Glu Glu Asp Leu Asn Leu Ala Ser Phe Leu Met Asp Arg Lys  
1040 1045 1050

Ala Ile Leu Pro Arg Val Ala His Glu Ile Leu Asp Asn Ser Leu  
1055 1060 1065

Thr Gly Val Arg Glu Ala Ile Ala Gly Met Leu Asp Thr Thr Lys  
1070 1075 1080

Ser Leu Val Arg Ala Ser Val Arg Arg Gly Gly Leu Ser Tyr Ser  
1085 1090 1095



Ile Leu	Arg Arg	Leu Ile	Asn Tyr	Asp Leu	Leu Gln	Tyr Glu	Thr
1100			1105			1110	
Leu Thr	Arg Thr	Leu Arg	Lys Pro	Val Lys	Asp Asn	Ile Glu	Tyr
1115			1120			1125	
Glu Tyr	Met Cys	Ser Val	Glu Leu	Ala Ile	Gly Leu	Arg Gln	Lys
1130			1135			1140	
Met Trp	Phe His	Leu Thr	Tyr Gly	Arg Pro	Ile His	Gly Leu	Glu
1145			1150			1155	
Thr Pro	Asp Pro	Leu Glu	Leu Leu	Arg Gly	Ser Phe	Ile Glu	Gly
1160			1165			1170	
Ser Glu	Ile Cys	Lys Phe	Cys Arg	Ser Glu	Gly Asn	Asn Pro	Met
1175			1180			1185	
Tyr Thr	Trp Phe	Tyr Leu	Pro Asp	Asn Ile	Asp Leu	Asp Thr	Leu
1190			1195			1200	
Ser Asn	Gly Ser	Pro Ala	Ile Arg	Ile Pro	Tyr Phe	Gly Ser	Ala
1205			1210			1215	
Thr Asp	Glu Arg	Ser Glu	Ala Gln	Leu Gly	Tyr Val	Lys Asn	Leu
1220			1225			1230	
Ser Lys	Pro Ala	Lys Ala	Ala Ile	Arg Ile	Ala Met	Val Tyr	Thr
1235			1240			1245	
Trp Ala	Tyr Gly	Thr Asp	Glu Ile	Ser Trp	Met Glu	Ala Ala	Leu
1250			1255			1260	
Ile Ala	Gln Thr	Arg Ala	Asn Leu	Ser Leu	Glu Asn	Leu Lys	Leu
1265			1270			1275	
Leu Thr	Pro Val	Ser Thr	Ser Thr	Asn Leu	Ser His	Arg Leu	Arg
1280			1285			1290	
Asp Thr	Ala Thr	Gln Met	Lys Phe	Ser Ser	Ala Thr	Leu Val	Arg
1295			1300			1305	
Ala Ser	Arg Phe	Ile Thr	Ile Ser	Asn Asp	Asn Met	Ala Leu	Lys
1310			1315			1320	

Glu Ala	Gly Glu Ser Lys Asp	Thr Asn Leu Val Tyr	Gln Gln Ile
1325	1330		1335
Met Leu	Thr Gly Leu Ser Leu	Phe Glu Phe Asn Met	Arg Tyr Lys
1340	1345		1350
Gln Gly	Ser Leu Ser Lys Pro	Met Ile Leu His Leu	His Leu Asn
1355	1360		1365
Asn Lys	Cys Cys Ile Ile Glu	Ser Pro Gln Glu Leu	Asn Ile Pro
1370	1375		1380
Pro Arg	Ser Thr Leu Asp Leu	Glu Ile Thr Gln Glu	Asn Asn Lys
1385	1390		1395
Leu Ile	Tyr Asp Pro Asp Pro	Leu Lys Asp Ile Asp	Leu Glu Leu
1400	1405		1410
Phe Ser	Lys Val Arg Asp Val	Val His Thr Ile Asp	Met Asn Tyr
1415	1420		1425
Trp Ser	Asp Asp Glu Ile Ile	Arg Ala Thr Ser Ile	Cys Thr Ala
1430	1435		1440
Met Thr	Ile Ala Asp Thr Met	Ser Gln Leu Asp Arg	Asp Asn Leu
1445	1450		1455
Lys Glu	Met Ile Ala Leu Ile	Asn Asp Asp Asp Ile	Asn Ser Leu
1460	1465		1470
Ile Thr	Glu Phe Met Val Ile	Asp Ile Pro Leu Phe	Cys Ser Thr
1475	1480		1485
Phe Gly	Gly Ile Leu Ile Asn	Gln Phe Ala Tyr Ser	Leu Tyr Gly
1490	1495		1500
Leu Asn	Val Arg Gly Arg Asp	Glu Ile Trp Gly Tyr	Val Ile Arg
1505	1510		1515
Ile Ile	Lys Asp Thr Ser His	Ala Val Leu Lys Val	Leu Ser Asn
1520	1525		1530
Ala Leu	Ser His Pro Lys Ile	Phe Lys Arg Phe Trp	Asp Ala Gly
1535	1540		1545

Val	Val	Glu	Pro	Val	Tyr	Gly	Pro	Asn	Leu	Ser	Asn	Gln	Asp	Lys
1550						1555					1560			
Ile	Leu	Leu	Ala	Ile	Ser	Val	Cys	Glu	Tyr	Ser	Val	Asp	Leu	Phe
1565						1570					1575			
Met	Arg	Asp	Trp	Gln	Glu	Gly	Ile	Pro	Leu	Glu	Ile	Phe	Ile	Cys
1580						1585					1590			
Asp	Asn	Asp	Pro	Asn	Ile	Ala	Glu	Met	Arg	Lys	Leu	Ser	Phe	Leu
1595						1600					1605			
Ala	Arg	His	Leu	Ala	Tyr	Leu	Cys	Ser	Leu	Ala	Glu	Ile	Ala	Lys
1610						1615					1620			
Glu	Gly	Pro	Lys	Leu	Glu	Ser	Met	Thr	Ser	Leu	Glu	Arg	Leu	Glu
1625						1630					1635			
Ser	Leu	Lys	Glu	Tyr	Leu	Glu	Leu	Thr	Phe	Leu	Asp	Asp	Pro	Ile
1640						1645					1650			
Leu	Arg	Tyr	Ser	Gln	Leu	Thr	Gly	Leu	Val	Ile	Lys	Ile	Phe	Pro
1655						1660					1665			
Ser	Thr	Leu	Thr	Tyr	Ile	Arg	Lys	Ser	Ser	Ile	Lys	Val	Leu	Arg
1670						1675					1680			
Val	Arg	Gly	Ile	Gly	Ile	Pro	Glu	Val	Leu	Glu	Asp	Trp	Asp	Pro
1685						1690					1695			
Asp	Ala	Asp	Ser	Met	Leu	Leu	Asp	Asn	Ile	Thr	Ala	Glu	Val	Gln
1700						1705					1710			
His	Asn	Ile	Pro	Leu	Lys	Lys	Asn	Glu	Arg	Thr	Pro	Phe	Trp	Gly
1715						1720					1725			
Leu	Arg	Val	Ser	Lys	Ser	Gln	Val	Leu	Arg	Leu	Arg	Gly	Tyr	Glu
1730						1735					1740			
Glu	Ile	Lys	Arg	Glu	Glu	Arg	Gly	Arg	Ser	Gly	Val	Gly	Leu	Thr
1745						1750					1755			
Leu	Pro	Phe	Asp	Gly	Arg	Tyr	Leu	Ser	His	Gln	Leu	Arg	Leu	Phe
1760						1765					1770			

Gly Ile	Asn Ser Thr Ser Cys	Leu Lys Ala Leu Glu	Leu Thr Tyr
1775	1780	1785	
Leu Leu	Asn Pro Leu Val Asn	Lys Asp Lys Asp Arg	Leu Tyr Leu
1790	1795	1800	
Gly Glu	Gly Ala Gly Ala Met	Leu Ser Cys Tyr Asp	Ala Thr Leu
1805	1810	1815	
Gly Pro	Cys Met Asn Tyr Tyr	Asn Ser Gly Val Asn	Ser Cys Asp
1820	1825	1830	
Leu Asn	Gly Gln Arg Glu Leu	Asn Ile Tyr Pro Ser	Glu Val Ala
1835	1840	1845	
Leu Val	Gly Lys Lys Leu Asn	Asn Val Thr Ser Leu	Cys Gln Arg
1850	1855	1860	
Val Lys	Val Leu Phe Asn Gly	Asn Pro Gly Ser Thr	Trp Ile Gly
1865	1870	1875	
Asn Asp	Glu Cys Glu Thr Leu	Ile Trp Asn Glu Leu	Gln Asn Asn
1880	1885	1890	
Ser Ile	Gly Phe Ile His Cys	Asp Met Glu Gly Gly	Glu His Lys
1895	1900	1905	
Cys Asp	Gln Val Val Leu His	Glu His Tyr Ser Val	Ile Arg Ile
1910	1915	1920	
Ala Tyr	Leu Val Gly Asp Lys	Asp Val Ile Leu Val	Ser Lys Ile
1925	1930	1935	
Ala Pro	Arg Leu Gly Thr Asp	Trp Thr Lys Gln Leu	Ser Leu Tyr
1940	1945	1950	
Leu Arg	Tyr Trp Arg Asp Val	Ser Leu Ile Val Leu	Lys Thr Ser
1955	1960	1965	
Asn Pro	Ala Ser Thr Glu Met	Tyr Leu Ile Ser Lys	Asp Pro Lys
1970	1975	1980	
Ser Asp	Ile Ile Glu Asp Ser	Asn Thr Val Leu Ala	Asn Leu Leu
1985	1990	1995	

Pro	Leu	Ser	Lys	Glu	Asp	Ser	Ile	Lys	Ile	Glu	Lys	Trp	Ile	Leu
2000						2005					2010			
Val	Glu	Lys	Ala	Lys	Val	His	Asp	Trp	Ile	Val	Arg	Glu	Leu	Lys
2015						2020					2025			
Glu	Gly	Ser	Ala	Ser	Ser	Gly	Met	Leu	Arg	Pro	Tyr	His	Gln	Ala
2030						2035					2040			
Leu	Gln	Ile	Phe	Gly	Phe	Glu	Pro	Asn	Leu	Asn	Lys	Leu	Cys	Arg
2045						2050					2055			
Asp	Phe	Leu	Ser	Thr	Leu	Asn	Ile	Val	Asp	Thr	Lys	Asn	Cys	Ile
2060						2065					2070			
Ile	Thr	Phe	Asp	Arg	Val	Leu	Arg	Asp	Thr	Ile	Phe	Glu	Trp	Thr
2075						2080					2085			
Arg	Ile	Lys	Asp	Ala	Asp	Lys	Lys	Leu	Arg	Leu	Thr	Gly	Lys	Tyr
2090						2095					2100			
Asp	Leu	Tyr	Pro	Leu	Arg	Asp	Ser	Gly	Lys	Leu	Lys	Val	Ile	Ser
2105						2110					2115			
Arg	Arg	Leu	Val	Ile	Ser	Trp	Ile	Ala	Leu	Ser	Met	Ser	Thr	Arg
2120						2125					2130			
Leu	Val	Thr	Gly	Ser	Phe	Pro	Asp	Ile	Lys	Phe	Glu	Ser	Arg	Leu
2135						2140					2145			
Gln	Leu	Gly	Ile	Val	Ser	Ile	Ser	Ser	Arg	Glu	Ile	Lys	Asn	Leu
2150						2155					2160			
Arg	Val	Ile	Ser	Lys	Ile	Val	Ile	Asp	Lys	Phe	Glu	Asp	Ile	Ile
2165						2170					2175			
His	Ser	Val	Thr	Tyr	Arg	Phe	Leu	Thr	Lys	Glu	Ile	Lys	Ile	Leu
2180						2185					2190			
Met	Lys	Ile	Leu	Gly	Ala	Val	Lys	Leu	Phe	Gly	Ala	Arg	Gln	Ser
2195						2200					2205			
Thr	Ser	Ala	Asp	Ile	Thr	Asn	Ile	Asp	Thr	Ser	Asp	Ser	Ile	Gln
2210						2215					2220			

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 <211> 2233  
 <212> PRT  
 <213> bovine parainfluenza virus 3

<400> 16

Met Asp Thr Glu Ser His Ser Gly Thr Thr Ser Asp Ile Leu Tyr Pro  
 1 5 10 15

Glu Cys His Leu Asn Ser Pro Ile Val Lys Gly Lys Ile Ala Gln Leu  
 20 25 30

His Thr Ile Met Ser Leu Pro Gln Pro Tyr Asp Met Asp Asp Asp Ser  
 35 40 45

Ile Leu Ile Ile Thr Arg Gln Lys Ile Lys Leu Asn Lys Leu Asp Lys  
 50 55 60

Arg Gln Arg Ser Ile Arg Lys Leu Arg Ser Val Leu Met Glu Arg Val  
 65 70 75 80

Ser Asp Leu Gly Lys Tyr Thr Phe Ile Arg Tyr Pro Glu Met Ser Ser  
 85 90 95

Glu Met Phe Gln Leu Cys Ile Pro Gly Ile Asn Asn Lys Ile Asn Glu  
 100 105 110

Leu Leu Ser Lys Ala Ser Lys Thr Tyr Asn Gln Met Thr Asp Gly Leu  
 115 120 125

Arg Asp Leu Trp Val Thr Ile Leu Ser Lys Leu Ala Ser Lys Asn Asp  
 130 135 140

Gly Ser Asn Tyr Asp Ile Asn Glu Asp Ile Ser Asn Ile Ser Asn Val  
 145 150 155 160

His Met Thr Tyr Gln Ser Asp Lys Trp Tyr Asn Pro Phe Lys Thr Trp  
 165 170 175

Phe Thr Ile Lys Tyr Asp Met Arg Arg Leu Gln Lys Ala Lys Asn Glu  
 180 185 190

Ile Thr Phe Asn Arg His Lys Asp Tyr Asn Leu Leu Glu Asp Gln Lys  
 195 200 205

Asn Ile Leu Leu Ile His Pro Glu Leu Val Leu Ile Leu Asp Lys Gln  
 210 215 220

Asn Tyr Asn Gly Tyr Ile Met Thr Pro Glu Leu Val Leu Met Tyr Cys  
 225 230 235 240

Asp Val Val Glu Gly Arg Trp Asn Ile Ser Ser Cys Ala Lys Leu Asp  
 245 250 255

Pro Lys Leu Gln Ser Met Tyr Tyr Lys Gly Asn Asn Leu Trp Glu Ile  
 260 265 270

Ile Asp Gly Leu Phe Ser Thr Leu Gly Glu Arg Thr Phe Asp Ile Ile  
 275 280 285

Ser Leu Leu Glu Pro Leu Ala Leu Ser Leu Ile Gln Thr Tyr Asp Pro  
 290 295 300

Val Lys Gln Leu Arg Gly Ala Phe Leu Asn His Val Leu Ser Glu Met  
 305 310 315 320

Glu Leu Ile Phe Ala Ala Glu Cys Thr Thr Glu Glu Ile Pro Asn Val  
 325 330 335

Asp Tyr Ile Asp Lys Ile Leu Asp Val Phe Lys Glu Ser Thr Ile Asp  
 340 345 350

Glu Ile Ala Glu Ile Phe Ser Phe Phe Arg Thr Phe Gly His Pro Pro  
 355 360 365

Leu Glu Ala Ser Ile Ala Ala Glu Lys Val Arg Lys Tyr Met Tyr Thr  
 370 375 380

Glu Lys Cys Leu Lys Phe Asp Thr Ile Asn Lys Cys His Ala Ile Phe  
 385 390 395 400

Cys Thr Ile Ile Ile Asn Gly Tyr Arg Glu Arg His Gly Gly Gln Trp  
 405 410 415

Pro Pro Val Thr Leu Pro Val His Ala His Glu Phe Ile Ile Asn Ala  
 420 425 430

Tyr Gly Ser Asn Ser Ala Ile Ser Tyr Glu Asn Ala Val Asp Tyr Tyr  
 435 440 445

Lys Ser Phe Ile Gly Ile Lys Phe Asp Lys Phe Ile Glu Pro Gln Leu  
 450 455 460

Asp Glu Asp Leu Thr Ile Tyr Met Lys Asp Lys Ala Leu Ser Pro Lys  
 465 470 475 480

Lys Ser Asn Trp Asp Thr Val Tyr Pro Ala Ser Asn Leu Leu Tyr Arg  
 485 490 495

Thr Asn Val Ser His Asp Ser Arg Arg Leu Val Glu Val Phe Ile Ala  
 500 505 510

Asp Ser Lys Phe Asp Pro His Gln Val Leu Asp Tyr Val Glu Ser Gly  
 515 520 525

Tyr Trp Leu Asp Asp Pro Glu Phe Asn Ile Ser Tyr Ser Leu Lys Glu  
 530 535 540

Lys Glu Ile Lys Gln Glu Gly Arg Leu Phe Ala Lys Met Thr Tyr Lys  
 545 550 555 560

Met Arg Ala Thr Gln Val Leu Ser Glu Thr Leu Leu Ala Asn Asn Ile  
 565 570 575

Gly Lys Phe Phe Gln Glu Asn Gly Met Val Lys Gly Glu Ile Glu Leu  
 580 585 590

Leu Lys Arg Leu Thr Thr Ile Ser Met Ser Gly Val Pro Arg Tyr Asn  
 595 600 605

Glu Val Tyr Asn Asn Ser Lys Ser His Thr Glu Glu Leu Gln Ala Tyr  
 610 615 620

Asn Ala Ile Ser Ser Ser Asn Leu Ser Ser Asn Gln Lys Ser Lys Lys  
 625 630 635 640

Phe Glu Phe Lys Ser Thr Asp Ile Tyr Asn Asp Gly Tyr Glu Thr Val  
 645 650 655

Ser Cys Phe Leu Thr Thr Asp Leu Lys Lys Tyr Cys Leu Asn Trp Arg  
 660 665 670

Tyr Glu Ser Thr Ala Leu Phe Gly Asp Thr Cys Asn Gln Ile Phe Gly  
 675 680 685



Leu Lys Glu Leu Phe Asn Trp Leu His Pro Arg Leu Glu Lys Ser Thr  
 690 695 700

Ile Tyr Val Gly Asp Pro Tyr Cys Pro Pro Ser Asp Ile Glu His Leu  
 705 710 715 720

Pro Leu Asp Asp His Pro Asp Ser Gly Phe Tyr Val His Asn Pro Lys  
 725 730 735

Gly Gly Ile Glu Gly Phe Cys Gln Lys Leu Trp Thr Leu Ile Ser Ile  
 740 745 750

Ser Ala Ile His Leu Ala Ala Val Lys Ile Gly Val Arg Val Thr Ala  
 755 760 765

Met Val Gln Gly Asp Asn Gln Ala Ile Ala Val Thr Thr Arg Val Pro  
 770 775 780

Asn Asn Tyr Asp Tyr Lys Val Lys Lys Glu Ile Val Tyr Lys Asp Val  
 785 790 795 800

Val Arg Phe Phe Asp Ser Leu Arg Glu Val Met Asp Asp Leu Gly His  
 805 810 815

Glu Leu Lys Leu Asn Glu Thr Ile Ile Ser Ser Lys Met Phe Ile Tyr  
 820 825 830

Ser Lys Arg Ile Tyr Tyr Asp Gly Arg Ile Leu Pro Gln Ala Leu Lys  
 835 840 845

Ala Leu Ser Arg Cys Val Phe Trp Ser Glu Thr Ile Ile Asp Glu Thr  
 850 855 860

Arg Ser Ala Ser Ser Asn Leu Ala Thr Ser Phe Ala Lys Ala Ile Glu  
 865 870 875 880

Asn Gly Tyr Ser Pro Val Leu Gly Tyr Val Cys Ser Ile Phe Lys Asn  
 885 890 895

Ile Gln Gln Leu Tyr Ile Ala Leu Gly Met Asn Ile Asn Pro Thr Ile  
 900 905 910

Thr Gln Asn Ile Lys Asp Gln Tyr Phe Arg Asn Ile His Trp Met Gln  
 915 920 925

Tyr Ala Ser Leu Ile Pro Ala Ser Val Gly Gly Phe Asn Tyr Met Ala  
 930 935 940

Met Ser Arg Cys Phe Val Arg Asn Ile Gly Asp Pro Thr Val Ala Ala  
 945 950 955 960

Leu Ala Asp Ile Lys Arg Phe Ile Lys Ala Asn Leu Leu Asp Arg Gly  
 965 970 975

Val Leu Tyr Arg Ile Met Asn Gln Glu Pro Gly Glu Ser Ser Phe Leu  
 980 985 990

Asp Trp Ala Ser Asp Pro Tyr Ser Cys Asn Leu Pro Gln Ser Gln Asn  
 995 1000 1005

Ile Thr Thr Met Ile Lys Asn Ile Thr Ala Arg Asn Val Leu Gln  
 1010 1015 1020

Asp Ser Pro Asn Pro Leu Leu Ser Gly Leu Phe Thr Ser Thr Met  
 1025 1030 1035

Ile Glu Glu Asp Glu Glu Leu Ala Glu Phe Leu Met Asp Arg Arg  
 1040 1045 1050

Ile Ile Leu Pro Arg Val Ala His Asp Ile Leu Asp Asn Ser Leu  
 1055 1060 1065

Thr Gly Ile Arg Asn Ala Ile Ala Gly Met Leu Asp Thr Thr Lys  
 1070 1075 1080

Ser Leu Ile Arg Val Gly Ile Ser Arg Gly Gly Leu Thr Tyr Asn  
 1085 1090 1095

Leu Leu Arg Lys Ile Ser Asn Tyr Asp Leu Val Gln Tyr Glu Thr  
 1100 1105 1110

Leu Ser Lys Thr Leu Arg Leu Ile Val Ser Asp Lys Ile Lys Tyr  
 1115 1120 1125

Glu Asp Met Cys Ser Val Asp Leu Ala Ile Ser Leu Arg Gln Lys  
 1130 1135 1140

Met Trp Met His Leu Ser Gly Gly Arg Met Ile Asn Gly Leu Glu  
 1145 1150 1155

Thr	Pro	Asp	Pro	Leu	Glu	Leu	Leu	Ser	Gly	Val	Ile	Ile	Thr	Gly
1160						1165					1170			
Ser	Glu	His	Cys	Arg	Ile	Cys	Tyr	Ser	Thr	Glu	Gly	Glu	Ser	Pro
1175						1180					1185			
Tyr	Thr	Trp	Met	Tyr	Leu	Pro	Gly	Asn	Leu	Asn	Ile	Gly	Ser	Ala
1190						1195					1200			
Glu	Thr	Gly	Ile	Ala	Ser	Leu	Arg	Val	Pro	Tyr	Phe	Gly	Ser	Val
1205						1210					1215			
Thr	Asp	Glu	Arg	Ser	Glu	Ala	Gln	Leu	Gly	Tyr	Ile	Lys	Asn	Leu
1220						1225					1230			
Ser	Lys	Pro	Ala	Lys	Ala	Ala	Ile	Arg	Ile	Ala	Met	Ile	Tyr	Thr
1235						1240					1245			
Trp	Ala	Phe	Gly	Asn	Asp	Glu	Ile	Ser	Trp	Met	Glu	Ala	Ser	Gln
1250						1255					1260			
Ile	Ala	Gln	Thr	Arg	Ala	Asn	Phe	Thr	Leu	Asp	Ser	Leu	Lys	Ile
1265						1270					1275			
Leu	Thr	Pro	Val	Thr	Thr	Ser	Thr	Asn	Leu	Ser	His	Arg	Leu	Lys
1280						1285					1290			
Asp	Thr	Ala	Thr	Gln	Met	Lys	Phe	Ser	Ser	Thr	Ser	Leu	Ile	Arg
1295						1300					1305			
Val	Ser	Arg	Phe	Ile	Thr	Ile	Ser	Asn	Asp	Asn	Met	Ser	Ile	Lys
1310						1315					1320			
Glu	Ala	Asn	Glu	Thr	Lys	Asp	Thr	Asn	Leu	Ile	Tyr	Gln	Gln	Val
1325						1330					1335			
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